

BID DOCUMENTS: June 17, 2022

# PROJECT MANUAL

VOLUME 2 OF 2 : DIVISIONS 02-33

## City School District of the City of New Rochelle

### Transfer to Capital – Storm Mitigation

Isaac E. Young Middle School  
William B. Ward Elementary School

SED#66-11-00-01-0-003-017  
SED#66-11-00-01-0-013-015

CSArch Project No. 188-2203



The design of this project conforms to applicable provisions of the New York State Uniform Fire Prevention and Building Code the New York State Energy Conservation Construction Code and the Manual of Planning Standards of the New York State Education Department

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Not Used

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END OF SECTION 000110



## SECTION 02 33 13 - UNDERGROUND UTILITY LOCATOR SERVICE

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. This Section includes:
  - 1. Requirements and standards for underground utility location services to be completed prior to commencement of construction.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.3 REFERENCES

- A. American Society of Civil Engineers, CI/ASCE 38-02, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data."
- B. American Public Works Association, Uniform Color Code."

#### 1.4 DEFINITIONS

- A. Utility Quality Levels:
  - 1. Level A: Precise horizontal and vertical location of utilities obtained by the actual exposure (or verification of previously exposed and surveyed utilities) and subsequent measurement of subsurface utilities, usually at a specific point. Minimally intrusive excavation equipment is typically used to minimize the potential for utility damage. A precise horizontal and vertical location, as well as other utility attributes, is shown on plan documents. Accuracy is typically set to 15-mm vertical and to applicable horizontal survey and mapping accuracy as defined or expected by the project owner.
  - 2. Level B: Information obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position of subsurface utilities. Quality level B data should be reproducible by surface geophysics at any point of their depiction. This information is surveyed to applicable tolerances defined by the project and reduced onto plan documents.

#### 1.5 DESCRIPTION

- A. Retain an independent utility locator service company with a minimum of five (5) years experience to field locate, mark, and stakeout existing underground utilities and service connections.

1. Level B locator service shall be performed in all project areas where excavations, regrading of the ground surface, and penetrations of the ground surface are to be performed.
  - a. Contractor shall include a minimum of 16 hours of Level A locator service to locate underground utilities as identified on the contract drawings or as identified during the Level B investigation that require more specific location, invert elevation, size, etc. Level A investigation shall only be performed at locations where shown or as directed.
  - b. In heavy metal areas, such as near perimeter fences, ground penetrating radar shall be used to determine the location of underground utilities. The use of equipment that induce a tracing signal along the utility path (such as a Metrotech unit) can cause false readings, shall not be used within five feet of fences.
2. The Level A investigation shall be performed as follows:
  - a. Hand excavation may be performed for depths of three feet or less.
  - b. Vacuum excavation shall be performed at depths greater than three feet.
  - c. All excavation test pits shall be backfilled by close of business that day.
3. Support and protect all utilities and service connections to remain in place.
4. The locator service shall field locate and mark underground utilities and service connections prior to excavation.
5. The contractor shall be responsible for coordinating the extent of the areas of subsurface investigation required to locate all underground utilities and service connections in the areas of excavation.
6. All costs associated with the repair of underground utilities and service connections hit/damaged during the investigative work shall be the responsibility of the contractor.
7. Utility location services shall be in accordance with the provisions of CIASCE 38-02, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data."

#### 1.6 SUBMITTALS

- A. Submit detailed experience and qualifications description of underground utility locator service. Experience and qualifications package should include a description of the types of utility locator equipment and experience that can be provided.
- B. Investigative Report:

1. Submit detailed written report and scaled drawings of the subsurface investigation, documenting all underground utilities and service connections located and identified.
  - a. All documentation shall be referenced to existing data (horizontal and vertical) previously established.
  - b. Provide three (3) paper copies and one (1) electronic copy of detailed written report and drawings.
  - c. Submit Investigative Report at least two weeks prior to advancing construction within the scheduled areas of excavation within the project site.

#### 1.4 COORDINATION AND SCHEDULE

- A. Coordinate the Work to determine the extent of the areas of subsurface investigation required to locate all underground utilities and service connections in the areas of excavation.
- B. Coordinate the Work with the Director's Representative to minimize utility disruptions and facility operations. Provide a schedule for the Work required to the Director's Representative for approval. Upon approval of the schedule, notify the Director's Representative a minimum of three (3) working days prior to performing the Work.
- C. Within the areas of excavation, all underground utilities and service connections shall be field located and their locations marked at least two (2) weeks prior to the performance of the required excavation work.

### PART 2 PRODUCTS (NOT USED)

### PART 3 EXECUTION

#### 3.1 WORK AREAS AND PERFORMANCE

- A. If any underground utilities and service connections are hit or damaged during the work, immediately inform the Owner and Engineer for directions on how to proceed.
- B. The utility locator service investigative work, field location and marking of underground utilities and service connections and submission of the investigative report must be completed before any excavation work can begin.
- C. Provide subsurface investigation information, detailed written report and drawings of the subsurface investigation, documenting all underground utilities and service connections located and identified, prior to the performance of the required excavation work.

- D. If during the Level B investigations, unknown underground utilities are discovered, the Engineer shall be notified as soon as possible or before the close of that business day.
- E. Field Marking of underground utilities shall follow the American Public Works Association (APWA) uniform color code:
  - 1. White: Proposed Excavation.
  - 2. Pink: Temporary Survey Markings.
  - 3. Red: Electric power lines, cables, conduit and lighting cables.
  - 4. Yellow: Gas, oil, steam, petroleum and gaseous material.
  - 5. Orange: Communications, alarm, signal lines, cables or conduit.
  - 6. Blue: Potable water.
  - 7. Purple: Reclaimed water, irrigation and slurry lines.
  - 8. Green: Sewer and drain lines.
- F. The Owner or Engineer may limit or restrict scheduling of the utility locator service based upon project progress.

END OF SECTION 02 33 13

## SECTION 024100 – DEMOLITION

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.
- B. Selective demolition of site elements for proposed improvements.

#### 1.2 RELATED REQUIREMENTS

- A. Section 015000 Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- B. Section 016000 Product Requirements: Handling and storage of items removed for salvage and relocation.
- C. Section 017300 Execution and Closeout Requirements: Project conditions; protection of benchmarks, survey control points and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- D. Section 017419 Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- E. Divisions 02-33 – Technical Specifications

#### 1.3 REFERENCE STANDARDS

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

### PART 2 - PRODUCTS (NOT USED)

### PART 3 - EXECUTION

#### 3.1 SCOPE

- A. Remove/backfill/replace existing concrete slabs, SAN and STM drainage piping, terrazzo and resilient flooring systems, fire-rated partitions, hollow metal doors/frames/hardware, and associated Work as indicated on Drawings.

- B. Remove other items indicated for salvage, relocation, and recycling.

### 3.2 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. Comply with applicable requirements of NFPA 241.
  - 3. Use of explosives is not permitted.
  - 4. 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.
  - 5. Provide, erect, and maintain temporary barriers and security devices.
  - 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 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. Protect existing structures and other elements that are not to be removed.

### 3.3 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 shown.
  - 2. Report discrepancies to Architect 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. Separate areas in which demolition is being conducted from other areas that are still occupied.
  - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings.

- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.
- E. Protect existing work to remain.
  - 1. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  - 2. Repair adjacent construction and finishes damaged during removal work.
  - 3. Patch as specified for patching new work.

#### 3.4 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 017419 Waste Management and Disposal.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 024100

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## SECTION 032000 - CONCRETE REINFORCING

### PART 1 - GENERAL

#### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Cast-In-Place Concrete Reinforcement: Section 033000

#### 1.02 SUMMARY

- A. Except as shown or specified otherwise, the Work of this Section shall conform to the applicable requirements of the following:
  - 1. Specifications for Structural Concrete, ACI 301-16 of the American Concrete Institute (ACI).
  - 2. Manual of Standard Practice, MSP-1-01 of the Concrete Reinforcing Steel Institute (CRSI).

#### 1.03 SUBMITTALS

- A. Shop Drawings: Placing drawings for bar reinforcement.
- B. Quality Control Submittals:
  - 1. Certificates: Affidavit required under Quality Assurance Article.

#### 1.04 QUALITY ASSURANCE

- A. Certifications: Affidavit by the bar reinforcement manufacturer certifying that bar material meets the contract requirements.
  - 1. Submit evidence of steel material compliance with this Specification. Evidence shall consist of certification of source of material, copies of purchase orders and manufacturer's certifications. For stock material, submit copies of latest mill or purchase orders for material replacement.
    - a. Documentation to confirm compliance with the General Conditions Article 25.4 Domestic Steel.
  - 2. Fabricator's and Erector's Qualification Data: Name and experience of erector and fabricator.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Bar Reinforcement: ASTM A 615, Grade 60, deformed steel bars
- B. Tie Wire: Black annealed wire, 16-1/2 gauge or heavier.
- C. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- D. Reinforcement Accessories:

## PART 3 - EXECUTION

### 3.01 PLACING

- A. ACI 301, Section 3.3 Execution:
  - 1. Replace the first sentence in paragraph 3.3.2.1 Tolerances- with the following:

Place, support, and fasten reinforcement as shown on the project drawing or approved shop submittal.
  - 2. Add the following paragraphs:

3.3.2.1.a At the time that concrete is placed, reinforcement shall be free of loose rust and loose mill scale.

3.3.2.3.f Bar Reinforcement: In rectangular panels of two-way construction, place the steel in the short direction first with the longer bars on top in the opposite direction.:

END OF SECTION 032000

## SECTION 033000 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Reinforcement: Section 032000.

#### 1.02 REFERENCES

- A. Except as shown or specified otherwise, the Work of this Section shall conform to the requirements of American Concrete Institute (ACI) and American Society for Testing and Materials (ASTM) documents.
  - 1. ACI 301-16: Specification for Structural Concrete for Buildings.
  - 2. ACI 302.1R-15: Guide for Concrete Floor and Slab Construction.
  - 3. ACI 304.2R-96: Placing Concrete by Pumping Methods.
  - 4. ACI 305R-10: Guide for Hot Weather Concreting.
  - 5. ACI 306R-10: Guide to Cold Weather Concreting.
  - 6. ACI 308.1-11: Standard Specification for Curing Concrete.
  - 7. ACI 318 -14 Building Code Requirements for Structural Concrete.
  - 8. ASTM C 94/C 94M – 11b: Standard Specification for Ready- Mixed Concrete.
  - 9. ASTM C 494/C 494M - 11: Standard Specification for Chemical Admixtures for Concrete.
  - 10. ACI RAP Bulletin 5 Field Guide to Concrete Repair Application Procedures, Surface Repair Using Form-and-Pump Techniques.

#### 1.03 DEFINITIONS

- A. Exposed Construction: Exposed to view.
- B. ACI 301, Section 1.2 - Definitions:
  - 1. Add the following definitions:
    - a. Cementitious Material: Cementitious materials include cement, ground blast furnace slag and fly ash.
    - b. Pumped Concrete: Concrete that is conveyed by pumping pressure through rigid pipe or flexible hose.
    - c. Water-to-Cementitious Ratio (w/c): A ratio representing quantity in pounds of free moisture available for cement hydration divided by quantity of cementitious materials in pounds per cubic yard concrete.

#### 1.04 SUBMITTALS

- A. Submittals Package: Submit product data for design mix(es) and materials for concrete specified below at the same time as a package.
- B. Product Data:
  - 1. Mix Design: Submit proposed concrete design mix(es) together with name and location of batching plant at least 28 days prior to the start of concrete work.
    - a. Include test results of proposed concrete proportions based on previous field experience or laboratory trial batches in accordance with ACI 301, Section 4.
    - b. Pumped Concrete: Include test results of proposed design mix(es) tested under actual field conditions with the maximum horizontal run and vertical lift required for this project.
  - 2. Portland Cement: Brand and manufacturer's name.
  - 3. Fly Ash: Name and location of source, and DOT test numbers.
  - 4. Air-entraining Admixture: Brand and manufacturer's name.
  - 5. Water-reducing Admixture: Brand and manufacturer's name.
  - 6. High Range Water-reducing Admixture (Superplasticizer): Brand and manufacturer's name.
  - 7. Aggregates: Name and location of source, and DOT test numbers.
  - 8. Chemical Curing and Anti-Spalling Compound: Brand and manufacturer's name, and application instructions.
  - 9. Bonding Agent (Adhesive): Brand and manufacturer's name, and preparation and application instructions.
- C. Quality Control Submittals:
  - 1. Batching Plant Records: At the end of each day of placing concrete, furnish the Owner's Representative with a legible copy of all batch records for the concrete placed.
  - 2. Concrete Pumping Equipment Data: Include manufacturer's name and model of principal components, type of pump, and type and diameter of pipe/hose.
  - 3. Minutes of the previous pre-installation conference.

#### 1.05 QUALITY ASSURANCE

- A. Qualifications of Crew Pumping Concrete: Workers pumping concrete shall have had at least one year of experience pumping concrete.
- B. Concrete batching plants shall be currently approved as concrete suppliers by the New York State Department of Transportation.

- C. Truck mixers for concrete shall be currently approved by the New York State Department of Transportation.
- D. Pumping equipment for pumped concrete shall be subject to the approval of the Owner's Representative.
- E. Fly ash supplier shall be on the New York State Department of Transportation's current "Approved List of Suppliers of Fly Ash".
- F. Source Quality Control: The Owner reserves the right to inspect and approve the following items, at his own discretion, either with his own forces or with a designated inspection agency:
  - 1. Batching and mixing facilities and equipment.
  - 2. Sources of materials.
- G. ACI 301, Section 1.4 Reference standards and cited publications:
  - 1. Add the following to the list of ASTM Standards:
    - a. C 311-11a Standard Methods of Sampling and Testing Fly Ash or Natural Pozzolans for Use As A Mineral Admixture in Portland Cement Concrete.
- H. Pre-Construction Conference: A minimum of 14 days prior to the initial submission of shop drawings, a conference will be held by the Owner's Representative at the Site for the purpose of reviewing the Contract Documents and discussing the requirements and procedures for submittals and for the Work. The conference shall be attended by the Contractor, the concrete supplier representative, and the reinforcement fabricator's project coordinator.
  - 1. If resilient flooring is to be placed on slab-on-grade, the meeting will also include discussion of curing procedures and moisture mitigation measures.

#### 1.06 DELIVERY

- A. ASTM C 94/C 94M, Article 14 - Batch Ticket Information: In addition to the information required by Paragraph 14.1, also include the following:
  - 1. Type and brand, and amount of cement.
  - 2. Weights of fine and coarse aggregates.
  - 3. Class and brand, and amount of fly ash (if any).

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Cement: ASTM C 150, Type I or II Portland cement.
- B. Water: Potable
- C. Air-entraining Admixture: ASTM C 260, and on the New York State Department of Transportation's current "Approved List".
- D. Water-reducing Admixture: ASTM C 494/C 494M, Type A, and on the New York State Department of Transportation's current "Approved List".
- E. High Range Water-reducing Admixture (Superplasticizer): ASTM C 494/C 494M, Type F, and on the New York State Department of Transportation's current "Approved List".
- F. Fly Ash: ASTM C 618, including Table 1 (except for footnote A), Class F except that loss on ignition shall not exceed 4.0 percent.
- G. ACI 301, Section 4.2.1.2 - Aggregates:
  - 1. Add the following paragraph:
    - a. Fine aggregate for pumped concrete shall meet the requirements of ASTM C 33, except 15 to 30 percent shall pass the No. 50 sieve and 5 to 10 percent shall pass the No. 100 sieve. The fineness modulus of the fine aggregate for pumped concrete shall not vary more than 0.20 from the average value used in proportioning.
- H. Moisture-Retaining Cover: Waterproof paper, polyethylene film, or polyethylene-coated burlap complying with ASTM C 171.
- I. Chemical Curing and Anti-Spalling Compound: ASTM C-309, Type 1D, Class B, with a minimum 18 percent total solids content. No thinning of material allowed.
  - 1. SureCure Emulsion, Kaufman Products, Inc. 3811 Curtis Avenue, Baltimore, MD 21226, (800) 637-6372.
  - 2. Cure & Seal by Symons Corp., 200 East Touhy Ave., PO Box 5018, Des Plaines, IL 60017-5018, (847) 298-3200.
  - 3. MasterKure CC 180 WB by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.

4. Cure & Seal 25 UV (J-22 UV) by Dayton Superior Corp., 1125 Byers Rd., Miamisburg, OH 45342, (800) 745-3700.
5. Acrylseal HS by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.

## 2.02 PROPORTIONING OF MIXES

- A. Cast-in-place concrete shall be air-entrained normal weight concrete except where indicated otherwise on the drawings.
  1. Normal weight concrete, except as otherwise specified, shall have a minimum compressive strength of 4,500 psi with a minimum of 611 pounds of cement per cubic yard. Slump: Maximum 3 inches; minimum 2 inches before the addition of any water-reducing admixtures or high-range water-reducing admixtures (superplasticizers) at the Site.
  2. Optional Material: Fly ash may be substituted for (Portland) cement in normal weight and lightweight concrete up to a maximum of 15 percent by weight of the required minimum (Portland) cement. If fly ash is incorporated in a concrete design mix, make necessary adjustments to the design mix to compensate for the use of fly ash as a partial replacement for (Portland) cement.
    - a. Adjustments shall include the required increase in air-entraining admixture to provide the specified air content.
    - b. Lower early strength of the concrete shall be considered in deciding when to remove formwork.
- B. Slump for Pumped Concrete: When a water-reducing admixture is not used, maximum slump shall be 4 inches. When a water-reducing admixture is used, maximum slump shall be 6 inches and when a high-range water-reducing admixture (superplasticizers) is used, maximum slump shall be 8 inches.
- C. Design Air Content: Refer to the structural drawings.
- D. Water-Cement Ratio: Refer to the structural drawings.
- E. Temperature. ASTM C 1064
- F. Admixtures: Do not use admixtures in concrete unless specified or approved in writing by the Owner's Representative.

## 2.04 PRODUCTION OF CONCRETE

- A. Provide ready-mixed concrete, either central-mixed or truck-mixed, unless otherwise approved in writing by the Owner's Representative.
- B. ACI 301, Section 5.3.2.1 Weather considerations
  - 1. Delete paragraph under 5.3.2.1.c - Hot Weather, and add the following:
    - a. 5.3.2.1.c Provide adequate controls to insure that the temperature of the concrete when placed does not exceed 90 degrees F., and make every effort to place it at a lower temperature. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set or cold joints. Ingredients may be cooled before mixing by shading the aggregates, fog spraying the coarse aggregate, chilling the mixing water or other approved means. Mixing water may be chilled with flake ice or well-crushed ice of a size that will melt completely during mixing, providing the water equivalent of the ice is calculated into the total amount of mixing water.
- C. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing.
  - 1. In cold weather, comply with ACI 306R.
    - a. When air temperature is below 40 degrees F (4 degrees C) heat the mixing water and, if necessary, the aggregates to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C) and not more than 80 degrees F (27 degrees C) at point of placement. If the mixing water is heated, do not exceed a temperature of 140 degrees F at the time it is added to the cement and aggregates.
  - 2. In hot weather, comply with ACI 305R.
    - a. When air temperature is between 85 degrees F (30 degrees C ) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.



### PART 3 - EXECUTION

#### 3.01 EXAMINATION AND PREPARATION

- A. Do not use items of aluminum for mixing, chuting, conveying, forming or finishing concrete, except magnesium alloy tools may be used for finishing.
- B. Check items of aluminum required to be embedded in the concrete and ensure that they are coated, painted or otherwise isolated in an approved manner.
- C. Hardened concrete, reinforcement, forms, and earth which will be in contact with fresh concrete shall be free from frost at the time of concrete placement.
- D. Do not deposit concrete in water. Keep excavations free of water by pumping or by other approved methods.
- E. Prior to placement of concrete, remove all hardened concrete spillage and foreign materials from the space to be occupied by the concrete.

#### 3.02 ADMIXTURE ADDITIONS AT THE SITE

- A. Site additions shall be limited to high-range water-reducers, non-chloride accelerators, and corrosion inhibitors. Comply with manufacturers' printed instructions for discharge of admixtures shall be furnished.
- B. High-Range Water-Reducers:
  - 1. Concrete shall arrive at a slump of 2 to 4 inches (50 to 100 mm). Water additions at the Site shall be limited to comply with water-to-cementitious ratio requirements.
  - 2. Following addition of high-range water-reduced concrete, a minimum of 70 revolutions or 5 minutes of mixing shall be completed to assure a consistent mixture.
- C. All concrete with other admixture additions shall mix a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.

#### 3.03 PLACING

- A. ACI 301, Section 5.3.2.3 Conveying equipment:
  - 1. Add the following paragraphs:

- a. 5.3.2.3.d When pumping concrete, the lubricating mortar for the delivery line shall not be discharged into an area of concrete placement.
  - b. 5.3.2.3.e The inside diameter of the delivery lines for pumped concrete shall be the greater of either a minimum of 5 inches or 3 times the maximum size of coarse aggregate.
- B. ACI 301, Section 5.3.2.2 - Conveying:
  - 1. Add the following paragraph:
    - a. Operation of truck mixers and agitators and discharge limitations shall conform to the requirements of ASTM C 94.
- C. ACI 301, Section 5.3.2.4 - Depositing:
  - 1. Add the following paragraph:
    - a. Do not allow concrete to free fall more than 4 feet.

#### 3.04 REPAIRING SURFACE DEFECTS

- A. ACI 301, Section 5.3.7 – Repair of surface defects:
  - 1. Add the following paragraph:
    - a. 5.3.7.1.a Finish patched areas to match the texture of the surrounding surface.
- B. ACI 301, Section 5.3.7.2 - Repair of tie holes:
  - 1. Delete last sentence in 5.3.7.2 and replace with the following:
    - a. The patch mixture shall consist of a mixture of dry-pack mortar, consisting of one-part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for placing and handling. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas 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.

#### 3.05 FINISHING FORMED SURFACES

- A. Smooth Rubbed Finish for exterior concrete surfaces exposed to view. surfaces shall meet the requirements of ACI 301-10 SF-3.0.

### 3.06 CURING AND PROTECTION

- A. Hot Weather Concreting: Comply with ACI 305R whenever the atmospheric temperature or the form surface temperature is at or above 90 degrees F., or climatic conditions of wind and/or low humidity will cause premature drying of the concrete.
- B. Curing Temperature: Maintain the temperature of the concrete at 50 degrees F. or above during the curing period. Keep the concrete temperature as uniform as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceeds 5 degrees F. in any one hour and 50 degrees F. in any 24-hour period.

### 3.07 FIELD QUALITY CONTROL

- A. ACI 301, Section 1.6.3.2 - Testing Services:
  - 1. Add the following paragraph:
    - a. Strength Tests for Pumped Concrete: Prepare strength test specimens and make strength tests from concrete samples obtained at the truck discharge chute and at the end of the pump delivery line.
- B. ACI 301, Section 1.6.2.3 – Tests required of Contractor's testing agency:
  - 1. Add the following paragraph:
    - a. Make available to the Owner's Representatives whatever test samples are required to make tests. Furnish shipping boxes for compression test cylinders.
- C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to the State and as accepted by the Owner's Representative. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Owner's Representative before using in the work.
- D. Test results will be reported in writing to the Owner's Representative, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and

materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

- E. Nondestructive Testing: Impact hammer, Windsor probe, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- F. Additional Tests: The State shall make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Owner's Representative. The testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Pay for such tests when unacceptable concrete is verified, including all inspection and Engineering fees when non-conforming work is verified.
- G. Moisture Testing: Test all concrete surfaces for moisture content that will receive a paint coating system. Test repeatedly until the desired moisture content is obtained.

END OF SECTION 033000

## SECTION 042000 - UNIT MASONRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
  - 1. Concrete masonry units (CMUs).
  - 2. Decorative concrete masonry units.
  - 3. Acoustic Masonry Units.
  - 4. Face brick.
  - 5. Stone trim units.
  - 6. Mortar and grout.
  - 7. Reinforcing steel.
  - 8. Masonry joint reinforcement.
  - 9. Ties and anchors.
  - 10. Embedded flashing.
  - 11. Miscellaneous masonry accessories.
  - 12. Cavity-wall insulation.
- B. Products furnished, but not installed, under this Section include the following:
  - 1. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 05 Section "Structural Steel Framing."
- C. Products installed, but not furnished, under this Section include the following:
  - 1. Steel lintels for unit masonry, furnished under Division 05 Section "Metal Fabrications."

#### 1.3 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.
- B. Match Existing: Material that is noted to match existing will match the entire masonry system including the masonry size, shape color, texture as well as the mortars size color

texture and joint finish. Metric sized masonry is not to be used as a match to imperial sized units.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths ( $f'_m$ ) at 28 days.
- B. Determine net-area compressive strength ( $f'_m$ ) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602 and Tables 2105.2.2.1.1 & 2105.2.2.1.2 in the Building Code of New York State.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
  - 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.
- C. Samples for Initial Selection: For the following:
  - 1. Decorative concrete masonry units, in the form of small-scale units.
  - 2. Face brick, in the form of straps of five or more bricks.
  - 3. Colored mortar.
- D. Samples for Verification: For each type and color of the following:
  - 1. Decorative concrete masonry units.
  - 2. Face brick, in the form of straps of five or more bricks.
  - 3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
  - 4. Weep holes/vents.
  - 5. Accessories embedded in masonry.

- E. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
  - 1. Masonry units.
    - a. Include material test reports substantiating compliance with requirements and FM2000.
    - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
  - 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.
- F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  - 1. Include test reports, per Building Code of New York State 2105.4 and ASTM C 780 for mortar mixes required to comply with property specification.
  - 2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- G. 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 and Tables 2105.2.2.1.1 & 2105.2.2.1.2 in the Building Code of New York State.
- H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

## 1.6 QUALITY ASSURANCE

- A. 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, through one source from a single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

- C. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
  - 1. Mortar Test For each mix required, per ASTM C 780 and Building Code of New York State 2105.4.
  - 2. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019 and Building Code of New York State 2105.5.
- D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockups for each type of exposed unit masonry construction in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness, including face and backup wythes and accessories.
    - a. Include a sealant-filled joint at least 16 inches (400 mm) long in each exterior wall mockup.
    - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
    - c. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
    - d. Include metal studs, sheathing, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.
  - 2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
  - 3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
  - 4. Protect accepted mockups from the elements with weather-resistant membrane.
  - 5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
    - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.



- b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
- 6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

#### 1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
  - 2. Where one (1) wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least twelve (12) hours and concentrated loads for at least three (3) days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that meet such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  2. Protect sills, ledges, and projections from mortar droppings.
  3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS602 and Building Code of New York State 2104.3.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

## 2.3 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  2. Provide bullnose units for (Interior) outside corners, unless otherwise indicated.
  3. Provide 'L' shaped blocks at all outside corners of CMU walls, unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent for (exterior) exposed units .
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water, or leaks on the back of test specimen.
    - a. Available Products:
      - 1) Addiment Incorporated; Block Plus W-10.
      - 2) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.
      - 3) Master Builders, Inc.; Rheopel.
      - 4) Forrer Industries; Dry-Block.
- C. Concrete Masonry Units: Building Code of New York State 2103.1.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.3 MPa).
  2. Weight Classification: Lightweight. Normal weight CMU shall be for load bearing walls as indicated on structural drawings.
  3. Size (Width): Manufactured to dimensions 3/8-inch less than nominal dimensions.
  4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample or where indicated on the drawings to "match existing", match the adjacent color and texture.
  5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.
- D. Decorative Concrete Masonry Units:
1. Basis of Design: Westbrook Concrete Block.
    - a. Approved equal: A. Jandris Block.

2. Type: Architectural CMU.
3. Texture: Ground-face.
4. Size: 8" x 8" x 16" nominal.
5. Finish: As selected by Architect from manufacturer's full range.

## 2.4 BRICK

### A. General: Provide shapes indicated and as follows:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

### B. Face Brick: ASTM C 216 , Grade SW , Type FBS .

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa).
2. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
5. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long.
6. Application: Use where brick is exposed, unless otherwise indicated.
7. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.
8. Products:
  - a. Continental Brick Company

## 2.5 MORTAR AND GROUT MATERIALS

### A. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

### B. Mortar Cement: ASTM C 1329.

1. Available Products:

- a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.
  - b. Or equal.
- C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
  - 1. Available Products:
    - a. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
    - b. Davis Colors; True Tone Mortar Colors.
    - c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
- D. Aggregate for Mortar: ASTM C 144.
  - 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 (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
  - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
- E. Aggregate for Grout: ASTM C 404.
- F. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- G. Cold-Weather Admixture: Non-chloride, non-corrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
  - 1. Available Products:
    - a. Addiment Incorporated; Mortar Kick.
    - b. Euclid Chemical Company (The); Accelguard 80.
    - c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
    - d. Sonneborn, Div. of ChemRex; Trimix-NCA.
    - e. Approved equal.
- H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
  - 1. Available Products:
    - a. Addiment Incorporated; Mortar Tite.

- b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
- c. Approved equal.

I. Water: Potable.

## 2.6 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Masonry Joint Reinforcement, General: ASTM A 951 Building Code of New York 2103.11.2.
  - 1. Interior Walls: Hot-dip galvanized, carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
  - 3. Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
  - 4. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
  - 5. Wire Size for Veneer Ties: W1.7 or 0.148-inch (3.8-mm) diameter.
  - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
  - 7. Provide in lengths of not less than 10 feet (3 m) with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.
  - 1. Available Products:
    - a. Hohmann & Barnard, Inc. #220
    - b. Dur-o-wall #DA3200
    - c. Approved equal
- D. Masonry Joint Reinforcement for Multi-wythe Masonry:
  - 1. Adjustable (two-piece) type, ladder design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
    - a. Available Products:
      - 1) Hohmann & Barnard, Inc. #285 Ladder with 3/16" BYNA-Lock wire tie
      - 2) Approved equal

- E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.188-inch- (4.8-mm-) diameter, stainless-steel continuous wire.

## 2.7 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
  - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
  - 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
  - 3. Stainless-Steel Sheet: ASTM A 666, Type 304.
- B. Corrugated Metal Ties: Not allowed anywhere.
- C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
- D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
  - 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
  - 2. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
  - 3. Wire: Fabricate from 3/16-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.
- E. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
  - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.
    - a. Available Products:
      - 1) Hohmann & Barnard, Inc. #359-C (with back plate)
      - 2) Approved equal.
  - 2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.25-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.
    - a. Available Products:

- 1) Hohmann & Barnard, Inc. #301W (size as required)
    - 2) Approved equal
  3. Anchor Section for Anchoring across movement joints: (2) 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire with (2) hot-dip galvanized plates.
    - a. Available Products:
      - 1) Hohmann & Barnard, Inc. #Slip-Set Stabilizer Style "H"
      - 2) Approved equal
- F. Partition Top anchors: 0.097-inch- (2.5-mm-) thick metal plate with 3/8-inch- (10-mm-) diameter metal rod 6 inches (150 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
  1. Available Products:
    - a. Hohmann & Barnard, Inc. #PTA-420, NS-TA, & PTA tube.
    - b. Approved equal.
- G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (600 mm) long, with ends turned up 2 inches (50 mm) or with cross pins, unless otherwise indicated.
  1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M .
    - a. Available Products:
      - 1) Hohmann & Barnard, Inc. #344
      - 2) Approved equal
- H. Adjustable Masonry-Veneer Anchors
  1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
    - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play more than 0.05 inch (1.3 mm).
  2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
    - a. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (150 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.



- b. Anchor Section: Sheet metal plate, 14 gage, 1-1/4 inches (32 mm) wide by length required, 5/8-inch (16 mm) wide by 5-1/2 inches (140 mm) long, stamped into center to provide a slot between strap and plate for inserting sheet metal plate.
  - c. Wire Ties: Triangular-, rectangular-, 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.
  - d. Available Products:
    - 1) Hohmann & Barnard, Inc.; DW-10-X.
    - 2) Wire-Bond; 1004, Type III-X.
3. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.
- a. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (75 mm) high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section. Size wire tie to extend at least 1-1/2 inches (38 mm) into veneer but with at least 5/8-inch (16-mm) cover on outside face.
  - b. Connector Section: Sheet metal clip welded to wire tie with integral tabs designed to engage continuous wire.
  - c. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (150 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
  - d. Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire. Size wire tie to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
  - e. Available Products:
    - 1) Hohmann & Barnard, Inc.; DW-10-X-Seismicclip.
    - 2) Wire-Bond; RJ-711 with Wire-Bond clip.
4. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads.
- a. Available Products:
    - 1) Dayton Superior Corporation, Dur-O-Wal Division; Stainless Steel SX Fastener.
    - 2) ITW Buildex; Scots long life Tek.
    - 3) Approved equal.

## 2.8 MISCELLANEOUS ANCHORS

- A. Special masonry anchors not specifically identified shall be provided as part of the work. Such anchors will be submitted to the architect for review prior to their use and shall meet the structural performance required.

## 2.9 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual " and as follows:
  - 1. Metal Drip Edges: Fabricate from stainless steel. Extend to inner width of wall and turn up 1 inch. Project drip edge 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed. Provide pre-fabricated corners free of sharp edges at all outside corner locations.
  - 2. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
- B. Flexible Flashing, Thru-Wall Flashing: Use the following unless otherwise indicated:
  - 1. Stainless Steel Fabric: 304 stainless steel sheet bonded to polymeric fabric with adhesive backing. Use only where flashing is fully concealed in masonry.
    - a. Products:
      - 1) Hohmann & Barnard, Inc.; Mighty Flash SA.
      - 2) York Flashings; Multi-Flash SS.
  - 2. Termination Bar: At all horizontal terminations:
    - a. Rigid Thermoplastic extrusion by York Flashings; Termination Bar.
- C. Solder and Sealants for Sheet Metal Flashings:
  - 1. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
  - 2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- D. 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: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene .
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 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 D 226, Type I (No. 15 asphalt felt).
- D. Mortar/Grout screen: At locations where grout isolation is required. ¼" square monofilament screen fabricated from high strength, non-corrosive polypropylene.
  - 1. Available Products:
    - a. Hohmann & Barnard, Inc. #MGS – Mortar / Grout Screen.
    - b. Approved equal.
- E. Weep/Vent Products: Use the following, unless otherwise indicated:
  - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
    - a. Products:
      - 1) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
      - 2) Heckmann Building Products Inc.; No. 85 Cell Vent.
      - 3) Hohmann & Barnard, Inc.; Quadro-Vent.
      - 4) Wire-Bond; Cell Vent.
- F. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
  - 1. Provide one of the following configurations:
    - a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent mesh from being clogged with mortar droppings.
  - 2. Available Products:
    - a. Archovations, Inc.; CavClear Masonry Mat.
    - b. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
    - c. Mortar Net USA, Ltd.; Mortar Net.
    - d. Approved equal.

- G. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

1. Available Products:

- 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.
- e. Approved equal.

- H. Self-Sealing Penetration Tape: Adhesive backed tape for use under surface applied veneer anchors as an air and moisture barrier.

1. Basis of Design: Hohmann & Barnard; X-Seal tape, or equal.

2.11 CAVITY-WALL INSULATION

- A. See Section 072100 Thermal Insulation.

2.12 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Available Manufacturers:

- a. Diedrich Technologies, Inc.
- b. EaCo Chem, Inc.
- c. ProSoCo, Inc.
- d. Approved equal.

2.13 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. Limit cementitious materials in mortar to Portland cement and lime.
  3. Limit cementitious materials in mortar for exterior and reinforced masonry to Portland cement and lime.
  4. 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 C 270 BIA Technical Notes 8A, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of mason.
1. For masonry below grade or in contact with earth, use Type S.
  2. For reinforced masonry, use Type S.
  3. For mortar parge coats, use 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. Pigmented Mortar: Use colored cement product [or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products].
1. Pigments shall not exceed ten percent (10%) of Portland cement by weight.
  2. Mix to match Architect's sample.
- E. Grout for Unit Masonry: Comply with ASTM C 476
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. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.
- F. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

## 2.14 SOURCE QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:
  - 1. Payment for these services will be made by Owner.
  - 2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

## 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 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.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. 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.

- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
  - 1. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, sizes and texture of existing masonry and mortar.
  - 1. Note: Bonding is different on the various additions. Note locations of the 'Flemish Bond' locations.
- G. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
  - 1. 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 (3 mm in 3 m), 1/4-inch in 20 feet (6 mm in 6 m), or 1/2-inch (12 mm) maximum.
  - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet (6 mm in 3 m), or 1/2-inch (12 mm) maximum.
  - 3. 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 (3 mm in 3 m), 1/4-inch in 20 feet (6 mm in 6 m), or 1/2-inch (12 mm) maximum.
  - 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
  - 5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
  - 6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.
  - 7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

### 3.3 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.
  - 1. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond ; do not use units with less than nominal 4-inch (100-

mm) horizontal face dimensions at corners or jambs. Note: Bonding is different on the various additions. Note locations of the 'Flemish Bond' indicated.

- B. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches (100-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. 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, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- F. 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.
- G. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
  - 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 (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) 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."

### 3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units 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 and slabs..
- B. Lay solid masonry units (and hollow masonry 4" in width and less) 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. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- D. Tool joints flush for masonry walls to receive plaster. unless otherwise indicated.
- E. Rake top of horizontal joints and fill with sealant

### 3.5 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together using one of the following methods:
1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. (0.16 sq. m) of wall area spaced not to exceed 16 inches (406 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
    - a. Where bed joints of wythes do not align or where the wythes are of different material, use adjustable (two-piece) type ties.
  2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
    - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes .
    - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties].
- B. Bond wythes of composite masonry together using bonding system indicated on Drawings.
- C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

- D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.
  - 1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
- E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
  - 1. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores or tooth intersecting walls together

### 3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
  - 1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. (0.16 sq. m) of wall area spaced not to exceed 16 inches (406 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
    - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
    - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.
  - 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
    - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement.
    - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement to allow for differential movement regardless of whether bed joints align.
  - 3. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Coat cavity face of backup wythe to comply with Division 07 Section "Bituminous Dampproofing." or "Air barrier" where indicated.
- E. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards,. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
  - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

### 3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
  - 1. Space reinforcement not more than 16 inches (406 mm) o.c.
  - 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
  - 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

### 3.8 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
  - 1. Provide an open space not less than 1 inch (25 mm) in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.

2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

### 3.9 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:
  1. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
  2. Embed tie sections and connector sections and continuous wire in masonry joints. Provide not less than 2 inches (50 mm) (unless noted otherwise) of air space between back of masonry veneer and face of sheathing.
  3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
  4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 16 inches (610 mm) o.c. horizontally, with not less than 1 anchor for each 1.66 sq. ft. of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.

### 3.10 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. Form control joints in concrete masonry as follows:
  1. Install preformed control-joint gaskets designed to fit standard sash block.
  2. Install control joints where shown on plans. If a masonry span exceeds 30 feet horizontally and no control joint is shown, provide a control joint every 30 feet +/- where directed by architect.
  3. Openings over 48" in width will have a control joint. Request location from architect if not shown on drawings.
  4. Openings over 96" in width will have two control joints. Request location from architect if not shown on drawings.
  5. Corners will have a control joint located within 24" of a corner. Request location from architect if not shown on drawings.
- C. Form expansion joints in brick made from clay or shale as follows:

1. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch (13 mm) for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 1/2 inch (13 mm).
  1. Locate horizontal, pressure-relieving joints beneath steel angles.

### 3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

### 3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows, unless otherwise indicated:
  1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place metal 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. Form end dams at (1" minimum tapering up to full flashing height) all location where water has the potential of flowing off the sides of the flashing back into adjacent masonry, or masonry cavities.
  2. At multi-wythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 12 inches (300mm), and 1-1/2 inches (38 mm) into the inner wythe. Form 1/4-inch (6-mm) hook in edge of flashing embedded in inner wythe.
  3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 12 inches (300mm); with upper edge

- tucked under building paper or building wrap, lapping at least 4 inches (100 mm). Secure with continuous termination bar.
4. At lintels and shelf angles, 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.
  5. Install stainless steel metal drip edges beneath fabric flashing at exterior face of wall. Stop fabric flashing 1/2 inch (13 mm) back from outside face of wall and adhere fabric flashing to top of metal drip edge in a full bed of butyl sealant.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing, at top of exterior wythes, and as follows:
1. Use specified weep/vent products to form weep holes.
  2. Space weep holes 24 inches (600 mm) o.c., unless otherwise indicated.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

### 3.13 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 temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602 Building Code of New York chapter 21.
- 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 Building Code of New York chapter 21 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 48 inches (1216mm).

### 3.14 FIELD QUALITY CONTROL

- A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
  - 1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
  - 1. Payment for these services will be made by Owner.
  - 2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.
- D. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.
- E. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.
- F. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.
- G. Prism Test: For each type of construction provided, per ASTM C 1314 at 7 days and at 28 days.

### 3.15 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 Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry 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 masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
7. Clean stone trim to comply with stone supplier's written instructions.

### 3.16 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.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
  2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
  3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000





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## SECTION 045020 – COLD (HOT) WEATHER MASONRY

### 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. Work of this Section includes all labor, materials, equipment and services necessary to complete the work of cold/hot weather masonry as shown on the Drawings, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, work necessary to comply with special requirements for undertaking masonry work specified in other sections when temperatures are below 40 deg F.

#### 1.3 QUALITY ASSURANCE

- A. General: Comply with requirements of Brick Industry Association (BIA), Technical Notes 1, Cold and Hot Weather Construction 2006, or as most recently updated; requirements specified in this Section; and requirements specified in individual sections requiring masonry work. In case of conflict, the strictest and most restrictive requirements shall govern.
- B. Prior Approval: Do not proceed with masonry work in cold/hot weather unless Architect has specifically approved in writing:
  - 1. Contractor's Work Proposal for cold/hot weather masonry.
  - 2. Specific masonry work to be undertaken in each case.
- C. Prohibited Materials: Do not add unapproved substances to mortars or grouts.
- D. Laws, Code and Regulations: Work of this Section shall comply with all applicable federal, state, and local laws, codes and regulations.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's published technical data for each product to be used in work of this Section including material description, chemical composition (ingredients and proportions), physical properties, recommendations for application and use, test

reports and certificates verifying that product complies with specified requirements, and material Safety Data sheets (MSDS).

- B. Work proposal for Col/Hot Weather Masonry: Proposal for executing masonry work as specified in other sections during cold/hot weather. Include proposed materials, equipment methods and procedures to ensure that cold/hot weather masonry work complies with requirements of this Section.

## 1.5 PROJECT CONDITIONS

- A. Protection of Building: Protect building elements, materials and finishes from damage and from deterioration caused by or resulting from work of this Section. Repair damage to materials and damage to finishes caused by or resulting from cold/hot weather masonry work to Restoration Consultant's satisfaction at no additional cost.
- B. Protection from Fire: Take all necessary precautions to prevent fire and spread of fire.
  - 1. Covers: membranes, insulation blankets and other materials used to cover masonry shall be flame retardant and fire resistant.
  - 2. Warming Devices: Heating blankets, infrared heaters and other warming devices shall be UL approved and inspected for damage before use.
  - 3. Open Flame Heaters: No open flame heaters shall be used to protect finished masonry. Heaters used to warm water or sand for mortar or grout shall be well away from building and from flammable substances.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Covers: Install membrane covers, insulation blankets and other protection to avoid damaging masonry. Do not drill holes in masonry or in any other way damage masonry.
- B. Misting equipment.

### 3.2 COLD WEATHER CONSTRUCTION

- A. General: Cold weather masonry work using cementitious mortars shall adhere to following requirements for work, performed in ambient temperatures indicated, as well

as all published guidelines in Brick Industry Association (BIA), Technical Notes I, Cold and Hot Weather Construction 2006, as updated. In case of conflict, most stringent requirements shall govern. Work shall not be permitted in freezing weather, or when temperature of air or wall is at or below freezing or expected to go below freezing within 48 hours of work without Architect's prior written approval. No work shall begin when any part of wall or materials in use are frozen or subject to freezing temperatures.

- B. Observe restoration mortar guidelines.
- C. Temperature Range 40 deg F to 32 deg F: Heat mixing water or sand to produce mortar between 40 deg F and 120 deg F and maintain above 40 deg F until placed at that temperature.
- D. Temperature Range 32 deg F to 20 deg F:
  - 1. Heat mixing water and sand to produce mortar between 40 deg F and 120 deg F. Heat grout materials so grout is maintained and placed at a temperature between 40 deg F and 120 deg F. Maintain mortar and grout above freezing until used in masonry.
  - 2. For work between 25 deg and 20 deg F, heat and maintain masonry units above 40 deg F if grouting.
- E. Temperature 20 deg F and Below: Heat mixing water and sand to produce mortar between 40 deg F and 120 deg F. Heat grout materials so grout is placed at a temperature between 40 deg F and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F. Provide enclosure to heat and maintain temperatures above freezing within enclosure.

### 3.3 HOT WEATHER CONSTRUCTION

- A. General: Hot weather masonry work using cementitious mortars shall adhere to following requirements for work, performed in ambient temperatures indicated, as well as all published guidelines in Brick Industry Association (BIA), Technical Notes I, Cold and Hot Weather Construction 2006, as updated. In case of conflict, most stringent requirements shall govern. Work shall not be permitted in extreme hot weather, when the ambient air temperature reaches 100 deg F or 90 Deg F with a wind velocity greater than 8 mph without Architect's prior written approval. Keep materials cool during periods of hot weather.
- B. Provide wet curing or fog misting if temperatures reach extremes noted in paragraph A. Keep equipment cool by flushing with cool before contact with mortar or mortar materials. Shade equipment and materials from direct sunlight. Use wind breaks to prevent rapid drying of mortar during and after placement. Cover walls with weather

resistant membrane at end of work day to prevent rapid loss of moisture from assemblies.

### 3.4 ADDITIONAL PROTECTION OF COMPLETED MASONRY WORK IN COLD WEATHER

- A. General: Protect completed masonry work in the following manner. Temperature ranges indicated apply to anticipated minimum night temperatures.
- B. Temperature range 40 deg F to 32 deg F: Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.
- C. Temperature range 32 deg F to 20 de F: Completely cover masonry with weather-resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.
- D. Temperature 20 deg F and Below: Except as otherwise indicated, maintain masonry temperature above 32 deg F for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods prevent to be satisfactory. For grouted masonry maintain heated enclosure to 40 deg F for 48 hours.

### 3.5 WASTE MANAGEMENT

- A. Coordinate with Division 01.
  - 1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
  - 2. Set aside and protect materials suitable for reuse and/or remanufacturing.
  - 3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 045020

## SECTION 055000 - METAL FABRICATIONS

### PART 1 GENERAL

#### 1.01 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Anchor Bolts: Installed under Section 033000.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- B. Metal Stairs: Section 055100.
- C. Painting: Section 099100.

#### 1.03 REFERENCES

- A. Except as shown or specified otherwise, the Work of this Section shall meet the requirements of the following:

- 1. Design, Fabrication, and Erection: "Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design" adopted by the American Institute of Steel Construction, June 1, 1989 (AISC Specification).
  - a. Design and Fabrication of Cold-Formed Shapes: "Specification for the Design of Cold-Formed Steel Structural Members", by the American Iron and Steel Institute (AISI Specification).
- 2. Welding: "Structural Welding Code - Steel, AWS D1.1", or "Structural Welding Code - Sheet Steel, AWS D1.3", by the American Welding Society (AWS Codes).

- B. Organizations:

- 1. AISC: American Institute of Steel Construction, One East Wacker Dr., Suite 700, Chicago, IL 60601-1802, 866-275-2472, [www.aisc.org](http://www.aisc.org).
- 2. AISI: American Iron and Steel Institute, 1140 Connecticut Ave., NW, Suite 705, Washington, D.C. 20036, (202) 452-7100, [www.steel.org](http://www.steel.org).
- 3. AWS: American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126, (800) 443-9353, [www.aws.org](http://www.aws.org).
- 4. ANSI: American National Standards Institute, 1819 L Street, NW, 6th Floor, Washington, DC 20036, (202) 293-8020, [www.ansi.org](http://www.ansi.org).
- 5. ASME: ASME International, 3 Park Ave., New York, NY 10016-5990, (800) 843-2763, [www.asme.org](http://www.asme.org).
- 6. ASTM: ASTM International, 100 Barr Harbor Dr., PO Box C700, West Conshohocken, PA, 19428-2959, (610) 832-9500, [www.astm.org](http://www.astm.org).
- 7. MPI: The Master Painters Institute Inc., 2808 Ingleton Ave., Burnaby, BC, V5C 6G7, (888) 674-8937, [www.specifypaint.com](http://www.specifypaint.com).

8. SSPC: The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh PA 15222-4656, (877) 281-7772, [www.sspc.org](http://www.sspc.org).

#### 1.04 SUBMITTALS

- A. Shop Drawings: Show application to project. Machine duplicated copies of Contract Drawings will not be accepted.
  - 1. Locate anchor bolts required for installation in other Work; furnish setting drawings and templates for required anchors.
  - 2. Indicate shop and field welds by standard AWS welding symbols in accordance with AWS A2.4.
- B. Product Data: Catalog sheets, specifications, and installation instructions for each fabricated item specified, except submit data for fasteners only when indicated.
- C. Quality Control Submittals:
  - 1. Certificates: Copy of certificates required under Quality Assurance Article.

#### 1.05 QUALITY ASSURANCE

- A. Galvanizing: Stamp galvanized items with galvanizer's name, weight of coating, and applicable ASTM number.
- B. Certificates:
  - 1. Affidavit by the structural steel manufacturer certifying that structural steel items meet the contract requirements.
    - a. Submit evidence of steel material compliance with this Specification. Evidence shall consist of certification of source of material, copies of purchase orders and manufacturer's certifications. For stock material, submit copies of latest mill or purchase orders for material replacement.
    - 1) Documentation to confirm compliance with General Conditions Article 25.4 Domestic Steel.
  - 2. The Contractor agrees, that if the value of this contract exceeds \$100,000 all structural steel, reinforcing steel and other major steel items to be incorporated in the Work of this Contract shall be produced and made in whole or substantial part in the United States, its territories or possessions.

#### 1.06 DELIVERY AND STORAGE

- A. Coordinate delivery of anchor bolts and other anchorage devices to be built into other construction to avoid delay.
- B. Promptly cover and protect steel items delivered to the site.



## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Wide Flange Structural Steel: ASTM A 36992, except as specified or shown otherwise.
- B. M and S-Shapes, Channels and Angles: ASTM A 36 or ASTM A 572, Grade 50.
- C. Steel Plates to be Bent or Cold-Formed: ASTM A 283, Grade C.
- D. Steel Bars and Bar-Size Shapes: ASTM A 675, Grade 70; or ASTM A 36.
- E. Merchant Quality Steel Bars: ASTM A 575, grade as selected by fabricator.
- F. Cold-Finished Steel Bars: ASTM A 108, grade as selected by fabricator.
- G. Hot-Rolled Carbon Steel Sheet and Strip: ASTM A 569, pickled and oiled.
- H. Cold-Rolled Carbon Steel Sheet: ASTM A 366, oiled.
- I. Galvanized Steel Sheet: ASTM A 526, with G90 hot-dip process zinc coating complying with ASTM A653.
- J. Steel Hollow Structural Sections (Round, Square, or Rectangular): ASTM A 500, Grade B; or ASTM A 500, Grade C.
- K. Cold-Drawn Steel Tubing: ASTM A 512, buttwelded, cold-finished carbon steel tubing, sink drawn and stress relieved.
- L. Cast Iron Castings: ASTM A 48, gray iron castings, Class 30.
- M. Malleable Iron Castings: ASTM A 47, grade as selected by fabricator.
- N. Steel Castings: ASTM A 27, grade and class as required by use of item.
- O. Steel Pipe: ASTM A 53, type as selected, Grade A; black finish unless galvanizing is required; standard weight (Schedule 40), unless otherwise shown or specified.
- P. Rolled Steel Floor Plate, Raised Pattern: ASTM A 786; raised herringbone pattern unless otherwise indicated.
- Q. Stainless Steel: Type 302/304; ASTM A 666 for plate, sheet and strip; ASTM A 276 for bars and shapes; ASTM A 269 for tubing.

R. Anchors: Except where shown or specified, select anchors of type, size, style, grade, and class required for secure installation of metal fabrications. For exterior use and where built into exterior walls, anchors shall be galvanized or of corrosive-resistant materials.

S. Fasteners: Except where shown or specified, select fasteners of type, size, style, grade, and class required for secure installation of metal fabrications. For exterior use and where built into exterior walls, fasteners shall be galvanized.

1. Standard Bolts and Nuts: ASTM A 307, Grade A, regular hexagon head.
2. Stainless Steel Fasteners: ASTM A 666; Type 302/304 for interior Work; Type 316 for exterior Work; Phillips flathead (countersunk) screws and bolts for exposed Work unless otherwise specified.
3. Eyebolts: ASTM A 489.
4. Machine Bolts: ASME B18.5 or ASME B18.9, Type, Class, and Form as required.
5. Machine Screws: ASME B18.6.3.
6. Lag Screws: ASME B18.2.1.
7. Wood Screws: Flat head, ASME B18.6.1.
8. Plain Washers: Round, ASME B18.22.1.
9. Lock Washers: Helical, spring type, ASME B18.21.1.
10. Toggle Bolts: Spring Wing Type; Wing AISI 1010, Trunion Nut AISI1010 or Zamac Alloy, Bolt Carbon Steel ANSI B18.6.3.

T. Shop Paint (General): Universal shop primer; fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

U. Shop Paint for Galvanized Steel: Epoxy zinc-rich primer; complying with MPI#20 and compatible with topcoat.

V. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

W. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

X. Bedding Mortar:

1. Cement Grout: Portland cement complying with ASTM C 150, Type I or III, and clean uniformly graded natural sand complying with ASTM C 404, size No. 2; mixed at a ratio (by volume) of 1.0 part cement to 3.0 parts sand,

with only the minimum amount of water required for placement and hydration.

2. Shrink-Resistant Grout (Ferrous): Factory-packaged, non-catalyzed, ferrous aggregate mortar grouting compound selected from the following:
  - a. Embeco 636 by Master Builders, 23700 Chagrin Blvd., Cleveland, OH 44122 (800) 227-3350.
  - b. Ferrolith G-NC by Sonneborn, Chemrex, Inc., 57-46 Flushing Ave., Maspeth, NY 11378, (800) 433-9517.
  - c. Ferro-Grout by L&M Construction Chemicals, 14851 Calhoun Rd., Omaha, NB 68152, (800) 362-3331.
  - d. Vibra-Foil by A.C. Horn, Inc., Tamm Industries, 7405 Production Dr., Mentor, OH 44060, (800) 862-2667.
3. Shrink-Resistant Grout (Non-Staining): Factory-packaged, non-ferrous mortar grouting compound selected from the following:
  - a. Masterflow 713 by Master Builders, 23700 Chagrin Blvd., Cleveland, OH 44122 (800) 227-3350.
  - b. SonogROUT by Sonneborn, Chemrex, Inc., 57-46 Flushing Ave., Maspeth, NY 11378, (800) 433-9517.
  - c. Five Star Grout by Five Star Products, Inc., 425 Stillson Rd., Fairfield, CT 06430, (800) 243-2206.
  - d. Crystex by L&M Construction Chemicals, 14851 Calhoun Rd., Omaha, NB 68152, (800) 362-3331.
  - e. Non-Corrosive, Non-Shrink Grout by A.C. Horn, Inc., Tamm Industries, 7405 Production Dr., Mentor, OH 44060, (800) 862-2667.

## 2.02 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Fabricate metal framing and supports, which are not a part of the structural steel framework, to support related items required by the Work.
- B. Fabricate units to the sizes, shapes, and profiles indicated or, if not indicated, of required dimensions to receive adjacent Work to be retained by the framing. Except as otherwise indicated, fabricate from structural steel shapes, plates, and bars, of all welded construction, with mitered corners, necessary brackets and splice plates, and a minimum number of joints for field connection. Punch, drill, and tap units to receive hardware and similar items to be anchored to the Work.
- C. When required to be built into masonry or cast-in-place concrete, equip units with integrally welded anchor straps. Unless otherwise indicated, anchors shall be minimum 1-1/4 x 1/4 x 8 inch steel straps, spaced 2 feet oc.
- D. Galvanize exterior steel framing and supports.

## 2.03 MISCELLANEOUS STEEL TRIM

A. Fabricate trim of shapes, sizes, and profiles shown. Fabricate units from steel shapes, plates, and bars, with continuously welded joints and smooth exposed edges, unless otherwise indicated. Use concealed field splices wherever possible. Furnish cutouts, fittings, and anchorages as required for assembly and installation.

B. Galvanize exterior steel trim.

#### 2.04 LOOSE BEARING PLATES

A. Steel plates fabricated flat, free from warp or twist, and of required thickness and bearing area. Drill plates as required for anchor bolts and for grouting access. Furnish bearing plates where shown and where required for steel items bearing on masonry or concrete construction.

#### 2.05 STEEL PIPE RAILINGS AND HANDRAILS

A. Fabricate railings and handrails of 1-1/2-inch (nominal) diameter steel pipe, unless otherwise shown.

B. Railings: Unless otherwise shown, railings shall consist of top rail and intermediate rails, with posts spaced not more than 5 feet oc. Close ends of rails which do not terminate with a flange or continuous return.

1. Space rails so that a sphere 4 inches in diameter cannot pass through the openings between the rails.
2. Join posts, rails, and corners by one of the following methods:
  - a. Flush-type steel railing fittings, welded and ground smooth, with railing splice locks secured with 3/8 inch hexagonal-recessed-head setscrews.
  - b. Coped and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding joints smooth. Butt railing splices and reinforce by a tight-fitting interior pipe sleeve not less than 6 inches long secured in place.
3. Railings may be bent at corners instead of joining, provided the bends are uniformly formed in jigs, with cylindrical cross-section of pipe maintained throughout the entire bend.
4. Unless otherwise shown, fabricate railings and accessories as necessary to secure posts and rail ends to construction as follows:
  - a. Anchor posts in concrete by means of post sleeves preset into the concrete.
  - b. Anchor posts to steel with steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to the steel supporting members.

- c. Anchor rail ends into concrete and solid masonry with round steel flanges welded to rail ends and anchored into the wall construction with expansion anchors.
    - d. Anchor rail ends to steel with oval or round steel flanges welded to rail ends and bolted or welded to the steel supporting members.
  - 5. Post Sleeves: Galvanized steel pipe not less than 6 inches long, and having an inside diameter not less than 1/2 inch greater than the outside diameter of the pipe post. Sleeve shall have a plate closure, sized to extend not less than 1 inch beyond the outside diameter of the sleeve, secured to the bottom of the sleeve.
    - a. Cover Flange: Round steel flange, sized to closely fit post and cover the sleeve.
- C. Handrails: Pipe handrails shall be secured to walls by means of wall brackets, and shall have a wall return fitting at each end of handrails unless otherwise shown.
  - 1. Wall Brackets: Malleable iron castings, with 3 inches projection from the finish wall surface to the center of the handrail, and with the wall plate portion of the bracket drilled to receive one 3/8-inch diameter bolt. Brackets shall be located approximately 6 inches from each end of handrails and intermediate brackets equally spaced at intervals not exceeding 5 feet oc. Fabricate wall brackets to secure to wall construction as follows:
    - a. Anchor into concrete and solid masonry with expansion anchors.
    - b. Anchor into hollow masonry and stud partitions with toggle bolts having square heads.
  - 2. Wall Return Fittings: Cast iron castings, flush-type, with the same projection as specified for wall brackets.
- D. Galvanize all exterior railings and handrails, and interior railings and handrails where indicated on the Drawings, including pipe, flanges, fittings, brackets, fasteners, and other ferrous metal components.

## 2.06 SAFETY NOSINGS

- A. Nosings: Cast, abrasive non-slip type, of profiles indicated, extending full length of concrete treads or other concrete edges to be protected unless otherwise indicated. Equip each nosing with integrally cast, welded, or riveted anchors located not more than 4 inches from each end of nosing and intermediate anchors spaced not over 15 inches oc. Abrasive grain shall be integrally cast into the wearing surface.
  - 1. Metal: Cast Iron.
  - 2. Tread Nosing Units: 4 inches wide x 5/16-inch thick, with 1-inch minimum deep protective front lip.
  - 3. Curb Bar Nosing Units: 1-1/2 x 1-1/2 x 3/8-inch thick.

4. Surface Design: Cross-hatched abrasive.

2.07 FABRICATION

- A. Use materials of the sizes and thicknesses indicated on the Drawings. If not indicated, use material of required size and thickness to produce adequate strength and durability for the intended use of the finished product.
- B. Fabricate items to be exposed to view of material entirely free of surface blemish, including pitting, roller and seam marks, rolled trade names, and roughness. Remove surface blemishes by grinding or by welding and grinding prior to cleaning, treating, and finishing.
- C. Form metal true to line, with accurate angles, surfaces, and straight edges. Ease exposed edges to a radius of approximately 1/32-inch unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the metal.
- D. Weld corners and seams continuously. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.
- E. Form exposed connections with flush, smooth, hairline joints. Use concealed fasteners wherever possible. Use Phillips flathead (countersunk) screws or bolts for exposed fasteners, unless otherwise shown or specified.
- F. Prepare fabricated items for anchorage of the type indicated, coordinated with the supporting structure. Fabricate and space anchoring devices as indicated or, if not indicated, as required to produce adequate support for the intended use of the item.
- G. Punch, reinforce, drill, and tap fabricated items as required to receive hardware and other appurtenant items.
- H. Galvanizing:
  - 1. In addition to specific items specified or noted to be galvanized, galvanize items attached to, embedded in, or supporting exterior masonry (including interior wythe of exterior masonry walls) and concrete Work.
  - 2. Unless otherwise specified or noted, items indicated to be galvanized shall receive a zinc coating by the hot-dip process, after fabrication, complying with the following:
    - a. ASTM A 123 for plain and fabricated material, and assembled products.
    - b. ASTM A 153 for iron and steel hardware.

I. Shop Painting:

1. Cleaning Steel: Thoroughly clean all steel surfaces. Remove oil, grease, and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning". Remove loose mill scale, loose rust, weld slag and spatter, and other detrimental material in accordance with SSPC SP-2 "Hand Tool Cleaning", SSPC SP-3 "Power Tool Cleaning", or SSPC SP-7 "Brush-Off Blast Cleaning".
2. Galvanized Items:
  - a. Galvanized items which are to be finish painted under Section 099101 shall be rinsed in hot alkali or in an acid solution and then in clear water.
  - b. Welded and abraded areas of galvanized surfaces shall be wire brushed and repaired with a coating of cold galvanizing compound.
3. Apply one coat of shop paint to all steel surfaces except as follows:
  - a. Do not shop paint steel surfaces to be field welded and steel to be encased in cast-in-place concrete.
  - b. Apply 2 coats of shop paint, before assembly, to steel surfaces inaccessible after assembly or erection, except surfaces in contact.
  - c. Do not paint galvanized items which are not to be finish painted under Section 099101.
4. Apply paint and compound on dry surfaces in accordance with the manufacturer's printed instructions, and to the following minimum thickness per coat:
  - a. Shop Paint (General): 4.0 mils wet film.
  - b. Shop Paint for Galvanized Steel: 3.0 mils wet film.
  - c. Galvanizing Repair Paint: 2.0 mils dry film.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Temporarily brace and secure items which are to be built into concrete, masonry, or similar construction.
- B. Isolate non-ferrous metal surfaces to be permanently fastened in contact with ferrous metal surfaces, concrete, or masonry by coating non-ferrous metal surface with bituminous mastic, prior to installation.

3.02 INSTALLATION

- A. Fit and set fabricated metal items accurately in designed locations, at proper elevation and alignment.
- B. Use anchorage devices and fasteners of required type, size, and number as required to provide a secure, rigid installation.
- C. Fit exposed connections accurately to form tight hairline joints. Weld connections which are not intended to be left as exposed joints, but cannot be shop welded because of size limitations. Grind welded joints smooth. Cut off exposed threaded portion of bolts flush with nut.
- D. Attached Work: Drill holes for fasteners with power tools to exact size required. Unless otherwise shown on the Drawings, fasten metal Work to concrete and solid masonry anchorage with expansion anchors. Fasten metal Work to hollow masonry and stud partitions with square head toggle bolts.
- E. Field Welding: Comply with AWS Codes for the procedures for shielded metal arc welding, for the appearance and quality of welds, and for the methods used in correcting welding Work.
- F. Railings: Adjust railings prior to securing in place to insure alignment and proper matching at joints. Plumb posts in each direction. Secure posts and rail ends to construction as follows:
  - 1. Anchor posts to steel with steel flanges, angle type or floor type as required. Weld flanges to posts, and bolt to the steel supporting members.
- G. Grating: Weld grating to supporting members, unless otherwise shown or specified.
  - 1. Secure removable panels with saddle clip anchor assemblies.

END OF SECTION 055000



## SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Framing with dimension lumber.
  - 2. Wood blocking and nailers.
  - 3. Wood furring and grounds.
  - 4. Wood sleepers.
  - 5. Plywood backing panels for electric, phone, technology, and mechanical panels

#### 1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of **2 inches nominal (38 mm actual)** or greater but less than **5 inches nominal (114 mm actual)** in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
  - 2. NHLA: National Hardwood Lumber Association.
  - 3. NLGA: National Lumber Grades Authority.
  - 4. SPIB: The Southern Pine Inspection Bureau.
  - 5. WCLIB: West Coast Lumber Inspection Bureau.
  - 6. WWPAA: Western Wood Products Association.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preserved treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply

with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following:
  1. Preservative-treated wood.
  2. Fire-retardant-treated wood.
  3. Power-driven fasteners.
  4. Powder-actuated fasteners.
  5. Expansion anchors.
  6. Metal framing anchors.

#### 1.6 QUALITY ASSURANCE

- A. Steel Source: All steel specified in the Section shall be produced or made in North America, for the following items:
  1. All types of Bolts.
  2. All types of Anchors.
- B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
  - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

### 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
  - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
  - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
  - 1. Use treatment that does not promote corrosion of metal fasteners.
  - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  - 3. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- D. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- E. Application: Treat items indicated on Drawings, and the following:
  - 1. Plywood backing panels.

## 2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Rooftop equipment bases and support curbs.
  - 4. Sleepers.
  - 5. Utility shelving.
- B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber and any of the following species:
  - 1. Hem-fir (north); NLGA.
  - 2. Spruce-pine-fir; NLGA.
  - 3. Hem-fir; WCLIB or WWPA.
- C. For utility shelving, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
  - 1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
  - 2. Hem-fir or hem-fir (north), Select Merchantable or No. 1 Common grade; NLGA, WCLIB, or WWPA.
- D. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
  - 1. Hem-fir or hem-fir (north), Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.
  - 2. Spruce-pine-fir (south) or spruce-pine-fir, Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used if it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For blocking and nailers used for attachment of other construction, select, and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

## 2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, C-C Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than **3/4-inch (19-mm)** nominal thickness.

## 2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

## 2.7 METAL FRAMING ANCHORS

- 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. Cleveland Steel Specialty Co.
  - 2. KC Metals Products, Inc.
  - 3. Phoenix Metal Products, Inc.
  - 4. Simpson Strong-Tie Co., Inc.

5. USP Structural Connectors.

- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, **G60 (Z180)** coating designation.
  - 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); **G185 (Z550)** coating designation; and not less than **0.036 inch (0.9 mm)** thick.
  - 1. Use for wood-preserved-treated lumber and where indicated.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304.
  - 1. Use for exterior locations and where indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
  - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than **0.025 inch (0.6 mm)**.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.



### 3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

### 3.3 PROTECTION

- A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

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## SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Interior standing and running trim.
2. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork items that are not concealed within other construction.
3. Shop priming of interior architectural woodwork.
4. Shop finishing of interior architectural woodwork.

- B. Related Requirements:

1. Section 061000 - Rough Carpentry for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.

#### 1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Wood-Preservative Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's

- written instructions for finishing treated material and manufacturer's written warranty.
2. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
  3. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Shop Drawings: For interior architectural woodwork.
1. Include plans, elevations, sections, and attachment details.
  2. Show large-scale details.
  3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
  4. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples: For each exposed product and for each color and finish specified, in manufacturer's or fabricator's standard size.
- D. Samples for Initial Selection: For each type of exposed finish.
- E. Samples for Verification: For the following:
1. Lumber for Transparent Finish: Not less than 5 inches (125 mm) wide by 12 inches (300 mm) long, for each species and cut, finished on one side and one edge.
  2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished interior architectural woodwork.
  3. Lumber and Panel Products with Shop-Applied Opaque Finish: 5 inches (125 mm) wide by 12 inches (300 mm) long for lumber and [8 by 10 inches (200 by 250 mm)] [12 by 12 inches (300 by 300 mm)] for panels, for each finish system and color.
    - a. Finish entire exposed surface.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Fabricator.
- B. Product Certificates: For the following:
1. Composite wood and agrifiber products.
  2. Adhesives.

- C. Evaluation Reports: For fire-retardant-treated wood materials, from ICC-ES.

## 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Build mockups of typical interior architectural woodwork as shown on Drawings.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

### 2.1 INTERIOR ARCHITECTURAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
  - 1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
  - 2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

### 2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Wood Species and Cut: See below.
  - 1. Species: White oak.
  - 2. Cut: Plain sliced/plain sawn.
  - 3. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
- C. For trim items wider than available lumber, use veneered construction. Do not glue for width.
  - 1. For veneered base, use hardwood lumber core, glued for width.
- D. For base wider than available lumber, glue for width. Do not use veneered construction.

### 2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (76 mm) wide.
  2. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
1. MDF: ANSI A208.2, Grade 130.
  2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

#### 2.4 PRESERVATIVE-TREATED-WOOD MATERIALS

- A. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWWPA N1 (dip, spray, flood, or vacuum-pressure treatment).
1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC), combined with a compatible EPA-registered insecticide.
  2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

#### 2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

## 2.6 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
  - 1. Edges of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
  - 2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).
- C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
  - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that parts fit as intended and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

## 2.7 SHOP PRIMING

- A. Interior Architectural Woodwork for Transparent Finish: Shop seal with stain (if required), other required pretreatments, and first coat of finish as specified in Section 099123 "Interior Painting."
- B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

## 2.8 SHOP FINISHING

- A. General: Finish interior architectural woodwork [with transparent finish] [indicated on Drawings] at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.



- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
  - 1. Backpriming: Apply one (1) coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two (2) coats to end-grain surfaces.
- C. Transparent Finish:
  - 1. Grade: Premium.
  - 2. Finish: System - 11, catalyzed polyurethane.
  - 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
  - 4. Staining: Match existing finish of interior wood, based on Architect's approval.
  - 5. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
  - 6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Before installation, condition interior architectural woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

#### 3.2 INSTALLATION

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed in the shop.

- C. Install interior architectural woodwork level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8-inch in 96 inches (3 mm in 2400 mm).
- D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends, and drilled holes according to AWPA M4.
- F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk, and filled flush with interior architectural woodwork.
  - 1. For shop-finished items, use filler matching finish of items being installed.
- H. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches (2400 mm) long except where shorter single-length pieces are necessary.
  - 1. Scarf running joints and stagger in adjacent and related members.
  - 2. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
  - 3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).
- I. Touch up finishing work specified in this Section after installation of interior architectural woodwork. Fill nail holes with matching filler where exposed.
  - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- J. See Section 099123 "Interior Painting" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects. Where not possible to repair, replace interior architectural woodwork. Adjust joinery for uniform appearance.
- B. Clean interior architectural woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

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## SECTION 072100 - THERMAL INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Extruded polystyrene foam-plastic board.
  - 2. Glass-fiber blanket.
  - 3. Mineral-wool blanket.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Low-emitting product certification.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
  - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

## PART 2 - PRODUCTS

### 2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.
- B. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Owens Corning; Foamular High R CW Plus.
  2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- C. Extruded Polystyrene Board, Type VI: ASTM C 578, Type VI, 25-psi (173-kPa) minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
  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. Owens Corning; Foamular 250.
  2. Location of Use: Below grade foundation wall, under slab.
    - a. R-Value/thickness: R=10, 2" thickness.
  3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

### 2.2 GLASS-FIBER BLANKET

- A. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
  1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

- B. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
  - 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. CertainTeed Corporation.
    - b. Guardian Building Products, Inc.
    - c. Johns Manville; a Berkshire Hathaway company.
    - d. Owens Corning.
- C. Glass-Fiber Blanket, Foil Faced: ASTM C 665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed Corporation; CertaPro Commercial Insulation or equal.
  - 2. 3-1/2 Inch = R-13.
  - 3. 6-1/4 inch = R-19.

## 2.3 MINERAL-WOOL BLANKETS

- A. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
  - 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. Industrial Insulation Group, LLC (IIG-LLC).
    - b. Roxul Inc.
    - c. Thermafiber, Inc.; an Owens Corning company.

## 2.4 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
  - 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. AGM Industries, Inc; Series T TACTOO Insul-Hangers.
  - b. Gemco; Spindle Type.
2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.

## 2.5 ACCESSORIES

### A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

### B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- #### A.
- Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

### 3.2 INSTALLATION, GENERAL

- #### A.
- Comply with insulation manufacturer's written instructions applicable to products and applications.
- #### B.
- Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- #### C.
- Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.



- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

### 3.3 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
  - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.

### 3.4 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
  - 1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

### 3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  - 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
  - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

### 3.6 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

## SECTION 078413 - PENETRATION FIRESTOPPING

### 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. Penetrations in fire-resistance-rated walls.
  - 2. Penetrations in horizontal assemblies.
  - 3. Penetrations in smoke barriers.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
  - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

## 1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

## 1.9 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
  - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

- a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
  - 1) UL in its "Fire Resistance Directory."
  - 2) Intertek Group in its "Directory of Listed Building Products."
  - 3) FM Global in its "Building Materials Approval Guide."

## 2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
  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. 3M Fire Protection Products.
    - b. A/D Fire Protection Systems Inc.
    - c. Hilti, Inc.
    - d. RectorSeal.
    - e. Specified Technologies, Inc.
    - f. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
  1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
  1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
  2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
  3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content:
  1. Sealants: 250 g/L.
  2. Sealant Primers for Nonporous Substrates: 250 g/L.
  3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
  1. Permanent forming/damming/backing materials.
  2. Substrate primers.
  3. Collars.
  4. Steel sleeves.

## 2.3 FILL MATERIALS

- A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- D. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

- G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
- I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

## 2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
  - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
  - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.

- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

### 3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire-resistance ratings.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
  - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:



1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

### 3.5 FIELD QUALITY CONTROL

- A. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- B. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

### 3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

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## SECTION 079200 – JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Non-staining silicone joint sealants.

#### 1.3 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each joint sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch (13 mm) wide joints formed between two )2) 6-inch (150 mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint Sealant Schedule: Include the following information:
  - 1. Joint sealant application, joint location, and designation.
  - 2. Joint sealant and backer rod compatibility.
  - 3. Joint sealant manufacturer and product name.
  - 4. Joint sealant formulation.
  - 5. Joint sealant color.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

## 1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## 1.8 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Five (5) years from date of Substantial Completion.
- B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  - 2. Disintegration of joint substrates from causes exceeding design specifications.
  - 3. Mechanical damage caused by individuals, tools, or other outside agents.
  - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
  - 1. Architectural sealants shall have a VOC content of 250 g/L or less.
  - 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### 2.2 NON-STAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
  - 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. Dow Corning Corporation; 756 SMS.
    - b. GE Construction Sealants; Momentive Performance Materials Inc.; Silpruf NB.
    - c. Pecora Corporation; 898NST.
    - d. Tremco Incorporated; Spectrem 3.

### 2.3 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

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. BASF Corporation-Construction Systems; MasterSeal 920 & 921 (Pre-2014: Sonolastic Backer Rod.)
- B. Cylindrical Sealant Backings: ASTM C 1330, or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
  - 3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

### 3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.



### 3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal non-traffic surfaces.
  - 1. Joint Locations:
    - a. Control and expansion joints in unit masonry.
    - b. Joints between different materials listed above.
    - c. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
    - d. Control and expansion joints in ceilings and other overhead surfaces.
    - e. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

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## SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Standard and custom hollow metal doors and frames.
  - 2. Steel sidelight, borrowed lite, and transom frames.
  - 3. Louvers installed in hollow metal doors.
  - 4. Light frames and glazing installed in hollow metal doors.

- B. Related Sections:

- 1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
  - 2. Division 08 Section "Flush Wood Doors".
  - 3. Division 08 Section "Stile and Rail Wood Doors".
  - 4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
  - 5. Division 08 Section "Door Hardware".
  - 6. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
  - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
  - 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
  - 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
  - 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.

6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
  1. Elevations of each door design.
  2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  4. Locations of reinforcement and preparations for hardware.
  5. Details of anchorages, joints, field splices, and connections.
  6. Details of accessories.
  7. Details of moldings, removable stops, and glazing.
  8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
  1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
  2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
  3. Smoke Control Door Assemblies: Comply with NFPA 105.
    - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## 1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from an SDI-Certified manufacturer:
  - 1. CECO Door Products (C).

2. Curries Company (CU).
3. Pioneer Industries (PI).

## 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

## 2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4-inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  1. Design: Flush panel.
  2. Core Construction: Manufacturer's standard vertical steel-stiffener core. Minimum 22-gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
  3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
  4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
  5. Hinge Reinforcement: Minimum 7-gauge (3/16") plate 1-1/4" x 9" or minimum 14-gauge continuous channel with pierced holes, drilled and tapped.
  6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  - 1. Design: Flush panel.
  - 2. Core Construction: Manufacturer's standard vertical steel-stiffener core. Minimum 22-gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
    - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
  - 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 1.
  - 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16-gauge, extending the full width of the door and welded to the face sheet.
  - 5. Hinge Reinforcement: Minimum 7-gauge (3/16") plate 1-1/4" x 9" or minimum 14-gauge continuous channel with pierced holes, drilled and tapped.
  - 6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Manufacturers Basis of Design:
  - 1. Curries Company (CU) - Steel-Stiffened - 747 Series.

## 2.4 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
  - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
  - 2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
  - 3. Manufacturers Basis of Design:
    - a. Curries Company (CU) – M G Series.
- C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.



1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
  2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
  3. Manufacturers Basis of Design:
    - a. Curries Company (CU) - C CM CG Series.
    - b. Curries Company (CU) - M G Series.
- D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

## 2.5 FRAME ANCHORS

- A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
  2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
  3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.6 LOUVERS

- A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
1. Blade Type: Vision proof inverted V or inverted Y.
  2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed, and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.

2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

## 2.7 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

## 2.8 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.9 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Continuous Hinge Reinforcement: Provide welded continuous 12-gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld joints continuously through full throat width of frames, including rabbets, soffits, and stops; grind, fill, dress, and make smooth, flush, and invisible.
  - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops require wider dimensions on glass side of frame.
5. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
6. Continuous Hinge Reinforcement: Provide welded continuous 12-gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
7. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
8. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
9. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
10. Jamb Anchors: Provide number and spacing of anchors as follows:

- a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
  - 1) Two anchors per jamb up to 60 inches high.
  - 2) Three anchors per jamb from 60 to 90 inches high.
  - 3) Four anchors per jamb from 90 to 120 inches high.
  - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
- b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
  - 1) Three anchors per jamb up to 60 inches high.
  - 2) Four anchors per jamb from 60 to 90 inches high.
  - 3) Five anchors per jamb from 90 to 96 inches high.
  - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
  - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
11. Door Silencers: Except on weather-stripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless of if specified in Division 08 Section "Door Hardware".
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
  1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

## 2.10 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead, and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

## 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. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
  2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
  3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
  4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

### 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113

## SECTION 081416 – FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Solid-core doors with wood-veneer faces.
  - 2. Factory finishing flush wood doors.
  - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
  - 4. Fire Rated Transom / Sidelight Panels
- B. Related Sections:
  - 1. Division 08 Section "Glazing" for glass view panels in flush wood doors.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
  - 1. Adhesives and composite wood products, certification product contains no urea formaldehyde.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
  - 1. Indicate dimensions and locations of mortises and holes for hardware.
  - 2. Indicate dimensions and locations of cutouts.
  - 3. Indicate requirements for veneer matching.
  - 4. Indicate doors to be factory finished and finish requirements.
  - 5. Indicate fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.
2. Frames for light openings, 6 inches long, for each material, type, and finish required.

E Warranty: Sample of special warranty.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.
- C. Qualify that adhesives and composite wood products contain no urea formaldehyde.
- D. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated." WDMA I.S.1-A, "Architectural Wood Flush Doors."
1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- E. Forest Certification: Provide doors made with all wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- F. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10B / UL 10C.
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
  2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- G. Pre-installation Conference: Conduct conference at Project site.



1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations:
  - 1. Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Per manufacturers written temperature and humidity requirements.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42 by 84-inch section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 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. Algoma Hardwoods, Inc.
  - 2. Eggers Industries.

3. Marshfield Door Systems, Inc.
4. Mohawk Flush Doors, Inc.; a Masonite Company.
5. Oshkosh Architectural Door Company.
6. VT Industries Inc.

## 2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- C. Particleboard-Core Doors:
  1. Particleboard: ANSI A208.1, Grade LD-2.
  2. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- D. Structural-Composite-Lumber-Core Doors:
  1. Structural Composite Lumber: WDMA I.S.10.
    - a. Screw Withdrawal, Face: 700 lbf.
    - b. Screw Withdrawal, Edge: 400 lbf.
- E. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
  1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
  2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- F. Mineral-Core Doors:
  1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
  2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
  3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

## 2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

### A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces.
2. Species: Select white maple.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Slip match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical and Top Edges: Same species as faces Applied wood edges of same species as faces and covering edges of crossbands.
8. Core: Particleboard or Structural composite lumber.
9. Construction: Five plies. Stiles and rails are bonded to core then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
10. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

## 2.4 LIGHT FRAMES

### A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

### B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

### C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.

### D. Metal Frames for Light Opening in Doors with Security Glass and Fire-Protection-Rated Security Glass:

1. Manufacturer: Basis-of-design product, provide National Guard Products Thru-bolted Lite Kit, model L-GLF100-TB or L-GLF100-SP-TB depending on glazing thickness, or approved equal.

2. Lite Kit to be powder-coated. Color to be selected by Architect from Manufacturer's full range.

E. Vision Lite Privacy Screen:

1. Manufacturer: Basis-of-design product, provide Activar Construction Products Group, Inc. Velo Privacy Screen – PS, or approved equal.
2. Color to be selected by Architect from Manufacturer's full range.
3. All Classroom and office doors to receive Vision Lite Privacy Screens.

2.5 Fire Rated Transom / Sidelight Panels

- A. Manufacturer: Basis-of-design product, provide Graham-Maiman, an ASSA ABLOY Group company, Fire Rated Transom Panels. Substitutions shall comply with Section 01600 – Product Requirements.
1. For transom panels up to 90 min fire rating: max size (4'-0" W x 3'-4" H)
  2. For sidelight panels up to 90 min fire rating: max size (4'-0" W x 9'-0" H)
  3. Maximum allowed clearance between frame and transom or sidelight panel cannot exceed 1/8" on all four sides.
  4. All fire rated transom and sidelight panel frames shall be field prepped by the GC to accommodate a 3/8" dia. hole in frame for spring bolts.
  5. Sizes: Coordinate sizes and fire ratings with Door Schedule located in bid documents.

2.6 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."
3. Louvers: Factory install louvers in prepared openings.

## 2.7 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
- C. Transparent Finish:
  1. Grade: Premium.
  2. Finish: AWI catalyzed polyurethane.
  3. Staining: As selected by Architect from manufacturer's full range.
  4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
  5. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
  1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jams.
  2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install non-rated wood doors per the following clearances, unless otherwise indicated:
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  2. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
    - a. Jambs and Head: 1/8 inch maximum.
    - b. Between Edges of Pairs of Doors: 1/8 inch maximum.
    - c. Between Bottom of Door and Top of Noncombustible Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Noncombustible Floor Finish (No Threshold): Maximum 3/4 inch.
    - e. Between Bottom of Door and Top of Rigid Floor Tile: Maximum 5/8 inch (16 mm).
    - f. Between Bottom of Door and Top of Class I Floor Covering: Maximum 1/2 inch (12 mm.)
  3. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
  4. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- A. Job-Fitted Doors for knock-down hollow metal frames: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
1. Non-Rated Wood Door Clearances: Provide of the following clearances unless otherwise indicated.
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  2. Fire-Rated Wood Door Clearances: Install doors with clearances according to NFPA 80.
    - a. Jambs and Head: 1/8 inch maximum.
    - b. Between Edges of Pairs of Doors: 1/8 inch maximum.
    - c. Between Bottom of Door and Top of Noncombustible Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Noncombustible Floor Finish (No Threshold): Maximum 3/4 inch.

- e. Between Bottom of Door and Top of Rigid Floor Tile: Maximum 5/8 inch.
    - f. Between Bottom of Door and Top of Class I Floor Covering: Maximum 1/2 inch.
  - 3. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
  - 4. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- B. Factory-Fitted Doors for welded hollow metal frames: Align in frames for uniform clearance at each edge.
- 1. Non-Rated Wood Door Clearances: Provide of the following clearances unless otherwise indicated.
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  - 2. Fire-Rated Wood Door Clearances: Install doors with clearances according to NFPA 80.
    - a. Jambs and Head: 1/8 inch maximum.
    - b. Between Edges of Pairs of Doors: 1/8 inch maximum.
    - c. Between Bottom of Door and Top of Noncombustible Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Noncombustible Floor Finish (No Threshold): Maximum 3/4 inch.
    - e. Between Bottom of Door and Top of Rigid Floor Tile: Maximum 5/8 inch (16 mm).
    - f. Between Bottom of Door and Top of Class I Floor Covering: Maximum 1/2 inch (12 mm.)
- C. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 ADJUSTING

- A. Operation: Re-hang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

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## SECTION 083110 – ACCESS DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Access doors and frames for walls and ceilings.
  - 2. Refer to access door allowances scheduled at the end of this specification section.
- B. Related Sections include the following:
  - 1. Division 03 Section "Cast-in-Place Concrete Site Work" for blocking out openings for access doors and frames in concrete.
  - 2. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
  - 3. Division 07 Section "Roof Accessories" for roof hatches.
  - 4. Division 08 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
  - 5. Division 23 Section "Duct Accessories" for heating and air-conditioning duct access doors.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

- E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. NFPA 252 or UL 10B for vertical access doors and frames.
  - 2. ASTM E 119 or UL 263 for horizontal access doors and frames.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

#### 1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

### PART 2 - PRODUCTS

#### 2.1 STEEL MATERIALS

- A. Steel Sheet: Electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed. Steel sheet of doors shall be minimum 20-gauge thickness at interior and exterior locations.
- B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Steel finishes shall be as indicated on Drawings. If not indicated in Drawings, access doors and frames shall be phosphate dipped and prime coated galvanized steel with final paint finish color as selected by Architect.
  - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel,

complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pre-treating.

## 2.2 STAINLESS-STEEL MATERIALS

- A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks.
  1. Finish: Polished Satin Finish No. 4.
- B. Provide stainless steel finish option where access panel requires moderately high corrosion resistance and where indicated per Drawings for stainless steel finish appearance.

## 2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- 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. Babcock-Davis, Cierra Products Co. (Basis-of-Design);
    - a. Cierra B-MT Series at Interior Non-Rated,
    - b. Cierra B-IT at Interior Fire-rated, and
    - c. Cierra B-XT at Exterior.
- B. Exterior, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from stainless steel sheet.
  1. Basis-of-Design: Babcock-Davis; Cierra B-XT Series.
  2. Locations: Exterior wall and ceiling surfaces.
  3. Door: 20-gauge stainless steel flush panel with a core of 2-inch thick, mineral-fiber insulation enclosed in sheet metal.
  4. Frame: Minimum 16-gauge thick stainless-steel sheet metal with 1¼-inch wide, surface-mounted trim.
  5. Hinges: Continuous stainless-steel piano.
  6. Latch: Lockable handle for exterior.
  7. Gasketing: Provide weathersealing gasket at perimeter of access door.
  8. Drip Cap: Provide continuous drip cap at top of frame of exterior access panel.
  9. Masonry Anchors: Provide where access door is constructed within masonry opening.

## 2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
  - 1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
  - 2. Provide mounting holes in frames for attachment of units to metal framing and / or wood blocking.
  - 3. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083110

## SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

B. RELATED SECTIONS:

1. Section 079200 Joint Sealants.
2. Section 087100 Door hardware.
3. Section 088000 Glazing.

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
  - a. Joinery, including concealed welds.
  - b. Anchorage.
  - c. Expansion provisions.
  - d. Glazing.

- e. Flashing and drainage.
- 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- 4. Include point-to-point wiring diagrams showing the following:
  - a. Power requirements for each electrically operated door hardware.
  - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
- C. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
  - 1. Joinery, including concealed welds.
  - 2. Anchorage.
  - 3. Expansion provisions.
  - 4. Glazing.
  - 5. Flashing and drainage.
- D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication, and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- E. Delegated Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Certificates:
  - 1. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
    - a. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- B. Test and Evaluation Reports:
  - 1. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.

- C. Source Quality-Control Submittals:
  - 1. Source quality-control reports.
- D. Field Quality-Control Submittals:
  - 1. Field quality-control reports.
- E. Qualification Statements:
  - 1. For Installer.
    - a. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAl) certificate.
- F. Delegated design engineer qualifications.
- G. Sample warranties.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For aluminum-framed entrances and storefronts.

#### 1.6 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installers: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.
  - 2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in New York where Project is located and who is experienced in providing engineering services of the type indicated.
  - 3. Testing Agency: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to Owner and Architect.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

#### 1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
  1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures, including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
    - e. Failure of operating components.
  2. Warranty Period: Five (5) years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Warranty Period: Five (5) years from date of Substantial Completion.



- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
  - 1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
    - c. Cracking, peeling, or chipping.
  - 2. Warranty Period: Five (5) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing spandrel panels and accessories, from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design.

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:

- a. Thermal stresses transferring to building structure.
  - b. Glass breakage.
  - c. Noise or vibration created by wind and thermal and structural movements.
  - d. Loosening or weakening of fasteners, attachments, and other components.
  - e. Failure of operating units.
- C. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
  1. Deflection Parallel to Glazing Plane: Limited to [amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than **1/8 inch (3.2 mm)**] <Insert deflection limit>.
    - a. Operable Units: Provide a minimum **1/16-inch (1.6-mm)** clearance between framing members and operable units.
- D. Structural: Test in accordance with ASTM E330/E330M as follows:
  1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
  2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
- E. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
  1. Thermal Transmittance (U-factor):
    - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than **0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K)** as determined in accordance with NFRC 100.
    - b. Entrance Doors: U-factor of not more than **1.10 Btu/sq. ft. x h x deg F (6.253 W/sq. m x K)** as determined in accordance with NFRC 100.
  2. Air Leakage:
    - a. Entrance Doors: Air leakage of not more than **1.0 cfm/sq. ft. (5.08 L/s per sq. m)** at a static-air-pressure differential of **1.57 lbf/sq. ft. (75 Pa)**.
  3. Condensation Resistance Factor (CRF):
    - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 70 as determined in accordance with AAMA 1503.

- b. Entrance Doors: CRF of not less than 68 as determined in accordance with AAMA 1503.
- F. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows.
  - 1. Outdoor-Indoor Transmission Class: Minimum 34.
- G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.3 STOREFRONT SYSTEMS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by the following:
  - 1. **Kawneer Company, Inc.; Arconic Corporation.**
  - 2. Approved equal.
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
  - 1. Interior Vestibule Framing Construction: Non-thermal.
  - 2. Glazing System: Retained mechanically with gaskets on four sides.
  - 3. Glazing Plane: Front.
  - 4. Finish: Clear anodic finish.
  - 5. Fabrication Method: Field-fabricated stick system.
  - 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  - 7. Steel Reinforcement: As required by manufacturer.
- C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, non-ferrous shims for aligning system components.
- E. Insulated Spandrel Panels:

1. Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
  - a. Overall Panel Thickness: 1 inch (25.4 mm).
  - b. Exterior Skin: Aluminum.
    - 1) Thickness: Manufacturer's standard for finish and texture indicated.
    - 2) Finish: Match framing system.
    - 3) Texture: Smooth.
    - 4) Backing Sheet: 1/8-inch- (3.2-mm-) thick, corrugated, high-density polyethylene.
  - c. Interior Skin: Aluminum.
    - 1) Thickness: Manufacturer's standard for finish and texture indicated.
    - 2) Finish: Matching storefront framing.
    - 3) Texture: Smooth.
    - 4) Backing Sheet: 0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene.
  - d. 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: 450 or less.

## 2.4 ENTRANCE DOOR SYSTEMS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by the following:
  1. Kawneer Company, Inc.; Arconic Corporation.
  2. Approved equal.
- B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
  1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated, and fillet welded or that incorporate concealed tie rods.
  2. Door Design: Wide stile; 5-inch (127-mm) nominal width.

3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
4. Finish: Match adjacent storefront framing finish.

## 2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article for each entrance door, to comply with requirements in this Section.
  1. Entrance Door Hardware Sets: Provide quantity, item, size, finish, or color indicated, and products complying with BHMA standard referenced.
  2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
  3. Opening-Force Requirements:
    - a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
    - b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.
- C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
  1. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Butt Hinges: BHMA A156.1, Grade 1, radius corner.
  1. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
  2. Exterior Hinges: Stainless steel, with stainless steel pin.
  3. Quantities:
    - a. For doors up to 87 inches (2210 mm) high, provide three hinges per leaf.
- E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

- F. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.
- G. Cylinders:
  - 1. As specified in Section 087100 "Door Hardware."
  - 2. BHMA A156.5, Grade 1.
    - a. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation to be furnished by Owner.
- H. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- I. Operating Trim: BHMA A156.6.
- J. Removable Mullions: BHMA A156.3 extruded aluminum.
  - 1. When used with panic exit devices, provide keyed removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305. Use only mullions that have been tested with exit devices to be used.
- K. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
- L. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.
- M. Door Stops: BHMA A156.16, Grade 1, floor- or wall-mounted, as appropriate for door location indicated, with integral rubber bumper.
- N. Weather Stripping: Manufacturer's standard replaceable components.
  - 1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
  - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- O. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- P. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

## 2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.
- D. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
  - 1. Color: Match structural sealant.

## 2.7 MATERIALS

- A. Sheet and Plate: **ASTM B209** (**ASTM B209M**).
- B. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221** (**ASTM B221M**).
- C. Structural Profiles: ASTM B308/B308M.

## 2.8 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
  - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of **1 inch (25.4 mm)** that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
  - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

## 2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
  - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using shear-block system.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
  - 1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
  - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
  - 2. At exterior doors, provide weather sweeps applied to door bottoms.



- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

## 2.10 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
  - 1. Color: As selected by Architect from full range of industry colors and color densities.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
  - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
  - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

### 3.3 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

### 3.4 INSTALLATION OF WEATHERSEAL SEALANT

- A. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

### 3.5 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

- A. Install entrance doors to produce smooth operation and tight fit at contact points.
  - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
  - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

### 3.6 ERECTION TOLERANCES

- A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
  - 1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m).

2. Level: **1/8 inch in 20 feet (3.2 mm in 6 m)**.
3. Alignment:
  - a. Where surfaces abut in line or are separated by reveal or protruding element up to **1/2 inch (12.7 mm)** wide, limit offset from true alignment to **1/16 inch (1.6 mm)**.
  - b. Where surfaces are separated by reveal or protruding element from **1/2 to 1 inch (12.7 to 25.4 mm)** wide, limit offset from true alignment to **1/8 inch (3.2 mm)**.
  - c. Where surfaces are separated by reveal or protruding element of **1 inch (25.4 mm)** wide or more, limit offset from true alignment to **1/4 inch (6 mm)**.
4. Location: Limit variation from plane to **1/8 inch in 12 feet (3.2 mm in 3.6 m)** over total length.

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections: Perform the following tests on representative areas of aluminum-framed entrances and storefronts.
  - a. Perform a minimum of one (1) test in areas as directed by Architect.
2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than **0.09 cfm/sq. ft. (0.45 L/s per sq. m)** at a static-air-pressure differential of **1.57 lbf/sq. ft. (75 Pa)**.
  - a. Perform a minimum of one (1) test in areas as directed by Architect.
3. Water Penetration: ASTM E1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than **6.24 lbf/sq. ft. (300 Pa)**, and shall not evidence water penetration.
4. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, each aluminum-framed entrance door located in an exit enclosure, each electrically controlled aluminum-framed egress door, and each aluminum-framed entrance door equipped with special locking arrangements, in accordance with NFPA 101, Section 7.2.1.15.

- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.8 MAINTENANCE SERVICE

- A. Entrance Door Hardware Maintenance:
  - 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
  - 2. Initial Maintenance Service: Beginning at Substantial Completion, provide six (6) months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 084113

## SECTION 087100 – DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Electromechanical door hardware.
  - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
  - 1. Division 06 Section "Rough Carpentry".
  - 2. Division 06 Section "Finish Carpentry".
  - 3. Division 08 Section "Hollow Metal Doors and Frames".
  - 4. Division 08 Section "Flush Wood Doors".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions, and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication, and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of PART 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
  - a. Elevation diagram of each unique access-controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
  - b. Complete (risers, point-to-point) access control system block wiring diagrams.
  - c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer, and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum five (5) years of documented experience in producing hardware and equipment like that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum three (3) years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum five (5) years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third-party source will not be accepted.
  - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Each unit to bear third-party permanent label demonstrating compliance with the referenced standards.
- F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  - 1. Function of building, purpose of each area and degree of security required.
  - 2. Plans for existing and future key system expansion.
  - 3. Requirements for key control storage and software.
  - 4. Installation of permanent keys, cylinder cores and software.
  - 5. Address and requirements for delivery of keys.
- G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
  - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal, and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.



2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access-controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software, or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software, and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties' involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

## 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One (1) year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
  - 1. Ten (10) years for mortise locks and latches.
  - 2. Five (5) years for exit hardware.
  - 3. Twenty-five (25) years for manual surface door closer bodies.
  - 4. Two (2) years for electromechanical door hardware.

## 1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door

Hardware Sets at the end of PART 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

## 2.2 HANGING DEVICES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible, and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
  1. Manufacturers:
    - a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
    - b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
    - c. Stanley Hardware (ST).

## 2.3 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
  1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
  2. Furnish dust proof strikes for bottom bolts.
  3. Surface bolts to be minimum 8-inch in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
  4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
  5. Manufacturers:
    - a. Door Controls International (DC).

- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).
- B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever, and inactive-leaf release trigger. Model as indicated in hardware sets.
  - 1. Manufacturers:
    - a. Door Controls International (DC).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).

## 2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum ten (10) years' experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
  - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
  - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
  - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  - 5. Keyway: Match Facility Standard.
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
  - 1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- E. Keying System: Each type of lock and cylinders to be factory keyed.
  - 1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.

2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

F. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Three (3).
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

G. Construction Keying: Provide temporary keyed construction cores.

H. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

## 2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:
  - a. Corbin Russwin Hardware (RU) – ML2000 Series.
  - b. No Substitution.

## 2.6 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
  - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
  - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2-inch-wide stiles.

8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
  10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
    - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    - b. Sargent Manufacturing (SA) - 80 Series.
    - c. Stanley Precision (PR) - Apex 2000 Series.

## 2.8 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
  2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
  4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
  5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
  6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
  1. Manufacturers:
    - a. Sargent Manufacturing (SA) - 351 Series.
    - b. Norton Door Controls (NO) - 7500 Series.
    - c. Stanley Precision (ST) – QDC100 Series.

## 2.9 ARCHITECTURAL TRIM

- A. Door Protective Trim
  1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
  2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
  3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
  4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
    - a. Stainless Steel: 300 grade, 050-inch thick.
  5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
  6. Manufacturers:



- a. Hiawatha, Inc. (HI).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Trimco (TC).

## 2.10 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

### 1. Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Trimco (TC).

- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm, and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

### 1. Manufacturers:

- a. Rixson Door Controls (RF).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Sargent Manufacturing (SA).

## 2.11 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
  - 1. National Guard Products (NG).
  - 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
  - 3. Reese Enterprises, Inc. (RE).

## 2.12 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.13 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings, and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

#### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

#### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops, or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work

specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating, and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware, and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products as listed in the door hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. Manufacturer's Abbreviations:
  - 1. RO - Rockwood
  - 2. RU - Corbin Russwin
  - 3. MC - Medeco
  - 4. HS - HES
  - 5. RF - Rixson
  - 6. NO - Norton
  - 7. PE - Pemko
  - 8. MK - McKinney
  - 9. SU - Securitron
  - 10. SA - SARGENT
  - 11. ROT - ROTON
  - 12. TRI - Trimco
  - 13. ZE - Zero
  - 14. AR - Adams Rite
  - 15. VD - Von Duprin

**Set: NRHS - 01.0**

Door: 161E

|                    |                      |     |     |
|--------------------|----------------------|-----|-----|
| 1 Mortise Cylinder | 20-061 ICX           | 626 | SCH |
| 1 FSIC Core        | 23-030               | 626 | SCH |
| All remaining HW   | By Overhead Door Mfr |     | B/O |

NOTE: VERIFY CYLINDER REQUIREMENTS WITH OVERHEAD DOOR MANUFACTURER

**Set: NRHS - 02.0**

Door: 161D

|                    |                      |     |     |
|--------------------|----------------------|-----|-----|
| 1 Mortise Cylinder | 20-061 ICX           | 626 | SCH |
| 1 FSIC Core        | 23-030               | 626 | SCH |
| All remaining HW   | By Overhead Door Mfr |     | B/O |

NOTE: VERIFY CYLINDER REQUIREMENTS WITH OVERHEAD DOOR MANUFACTURER

**Set: NRHS - 03.0**

Doors: 162B, 162C

|                          |                          |       |    |
|--------------------------|--------------------------|-------|----|
| 1 Continuous Hinge       | Full Mortise             | CL    |    |
| 1 Classroom Lock         | ML2055 NSA CT6SD         | 630   | RU |
| 1 Permanent Core         | Medeco X4                | 26    | MC |
| 1 Door Closer            | Standard or Parallel Arm | 689   |    |
| 1 Mop Plate              | K1050 8" high BEV CSK    | US32D | RO |
| 1 Kick Plate             | K1050 16" high BEV CSK   | US32D | RO |
| 1 Electromagnetic Holder | 998M                     | 689   | RF |
| 1 Gasketing              | S773BL                   |       | PE |

**Set: NRHS - 04.0**

Doors: 162D

|                    |                          |       |    |
|--------------------|--------------------------|-------|----|
| 1 Continuous Hinge | Full Mortise             | CL    |    |
| 1 Storeroom Lock   | ML2057 NSA CT6SD         | 630   | RU |
| 1 Permanent Core   | Medeco X4                | 26    | MC |
| 1 Door Closer      | Standard or Parallel Arm | 689   |    |
| 1 Mop Plate        | K1050 8" high BEV CSK    | US32D | RO |
| 1 Kick Plate       | K1050 16" high BEV CSK   | US32D | RO |
| 1 Gasketing        | S773BL                   |       | PE |

**Set: NRHS - 8.0**

Doors: 1302

|                           |                                       |       |    |
|---------------------------|---------------------------------------|-------|----|
| 2 Continuous Hinge        | Full Mortise                          | CL    |    |
| 1 Flush Bolt              | 2845                                  | US26D | RO |
| 1 Dust Proof Strike       | 570                                   | US26D | RO |
| 1 Classroom Intruder Lock | ML2002 NSA M19N CT6SD                 | 630   | RU |
|                           | x 1303-118 inside                     |       |    |
| 2 Permanent Core          | Medeco X4                             | 26    | MC |
| 1 Coordinator             | 2600 Series x mtg, brkts. as required | Black | RO |
| 2 Door Closer             | Standard or Parallel Arm              | 689   |    |
| 2 Mop Plate               | K1050 8" high BEV CSK                 | US32D | RO |
| 2 Kick Plate              | K1050 16" high BEV CSK                | US32D | RO |
| 2 Door Stop               | 400 / 441CU                           | US26D | RO |
| 1 Gasketing               | S773BL                                |       | PE |
| 1 Astragal                | S772BL                                |       | PE |

**Set: NRHS - 5.0**

Doors: 140AA, 140AB

|                           |                          |       |    |
|---------------------------|--------------------------|-------|----|
| 1 Continuous Hinge        | Full Mortise             | CL    |    |
| 1 Classroom Intruder Lock | ML2002 NSA M19N CT6SD    | 630   | RU |
|                           | x 1303-118 inside        |       |    |
| 2 Permanent Core          | Medeco X4                | 26    | MC |
| 1 Door Closer             | Standard or Parallel Arm | 689   |    |
| 1 Mop Plate               | K1050 8" high BEV CSK    | US32D | RO |
| 1 Kick Plate              | K1050 16" high BEV CSK   | US32D | RO |
| 1 Door Stop               | 400 / 441CU              | US26D | RO |
| 1 Gasketing               | S773BL                   |       | PE |
| 1 Astragal                | S772BL                   |       | PE |

**Set: IEY - 15.0**

Doors: 146B

|                           |                          |       |    |
|---------------------------|--------------------------|-------|----|
| 1 Continuous Hinge        | Full Mortise             | CL    |    |
| 1 Classroom Intruder Lock | ML2002 NSA M19N CT6SD    | 630   | RU |
|                           | x 1303-118 inside        |       |    |
| 2 Permanent Core          | Medeco X4                | 26    | MC |
| 1 Surf Overhead Stop      | 9-X36                    | 630   | RF |
| 1 Door Closer             | Standard or Parallel Arm | 689   |    |
| 1 Mop Plate               | K1050 8" high BEV CSK    | US32D | RO |
| 1 Kick Plate              | K1050 16" high BEV CSK   | US32D | RO |
| 1 Gasketing               | S773BL                   |       | PE |

**Set: NRHS - 7.0**

Doors: 140G, 140H, 140J, 140K

|                                |                          |     |    |
|--------------------------------|--------------------------|-----|----|
| 2 Continuous Hinge             | Full Mortise             | CL  |    |
| 1 Keyed Removable Mullion      |                          |     |    |
| 1 Exit Device (rim, storeroom) |                          | 630 |    |
| 1 Exit Device (rim, exit only) |                          | 630 |    |
| 2 Permanent Core               | Medeco X4                | 26  | MC |
| 2 SFIC Cylinder                | as required x temp. core | 26  | MC |
| 2 Conc Overhead Stop           | 1-X36                    | 630 | RF |
| 2 Door Closer                  | Standard or Parallel Arm | 689 |    |
| 1 Threshold                    | to architect detail      |     | PE |
| 1 Gasketing                    | 290APK x 2891APK         |     | PE |
| 2 Sweep                        | 18061CNB                 |     | PE |



**Set: IEY - 17.0**

Doors: 162A

|                                                 |                          |       |    |
|-------------------------------------------------|--------------------------|-------|----|
| 2 Continuous Hinge                              | Full Mortise             | CL    |    |
| 2 Exit Device (surface vertical rod, classroom) |                          | 630   | VD |
| 2 Permanent Core                                | Medeco X4                | 26    | MC |
| 2 SFIC Cylinder                                 | as required x temp. core | 26    | MC |
| 2 Door Closer                                   | Standard or Parallel Arm | 689   |    |
| 2 Mop Plate                                     | K1050 8" high BEV CSK    | US32D | RO |
| 2 Kick Plate                                    | K1050 16" high BEV CSK   | US32D | RO |
| 2 Door Stop                                     | 400 / 441CU              | US26D | RO |
| 1 Gasketing                                     | S773BL                   |       | PE |
| 1 Astragal                                      | S772BL                   |       | PE |

**Set: ALMS - 23.0**

Doors: 125, 127, 189, 21A, 23C

|                                |                          |       |    |
|--------------------------------|--------------------------|-------|----|
| 1 Continuous Hinge             | Full Mortise             | CL    |    |
| 1 Exit Device (rim, classroom) |                          | 630   |    |
| 1 Permanent Core               | Medeco X4                | 26    | MC |
| 1 SFIC Cylinder                | as required x temp. core | 26    | MC |
| 1 Door Closer                  | Standard or Parallel Arm | 689   |    |
| 1 Mop Plate                    | K1050 8" high BEV CSK    | US32D | RO |
| 1 Kick Plate                   | K1050 16" high BEV CSK   | US32D | RO |
| 1 Door Stop                    | 400 / 441CU              | US26D | RO |
| 1 Gasketing                    | S773BL                   |       | PE |

**Set: NRHS - 9.0**

Doors: C1008, C1400, 140F

|                                               |                          |       |     |
|-----------------------------------------------|--------------------------|-------|-----|
| 2 Continuous Hinge                            | Full Mortise             | CL    |     |
| 2 Exit Device (surface vertical rod, passage) |                          |       | 630 |
| 2 Door Closer                                 | Standard or Parallel Arm | 689   |     |
| 2 Drop Plate                                  | as required              | 689   |     |
| 2 Mop Plate                                   | K1050 8" high BEV CSK    | US32D | RO  |
| 2 Kick Plate                                  | K1050 8" high BEV CSK    | US32D | RO  |
| 2 Door Stop                                   | 400 / 441CU              | US26D | RO  |
| 1 Gasketing                                   | S773BL                   |       | PE  |
| 1 Astragal                                    | S772BL                   |       | PE  |

**Set: IEY 18.0**

Doors: C2

|                                        |              |    |     |
|----------------------------------------|--------------|----|-----|
| 2 Continuous Hinge                     | Full Mortise | CL |     |
| 2 Exit Device (surf vert rod, passage) |              |    | 630 |

DOOR HARDWARE

087100 - 22

CSArch  
188-2203

City School District of the City of New Rochelle  
Transfer to Capital – Storm Mitigation

|                          |                          |       |    |
|--------------------------|--------------------------|-------|----|
| 2 Door Closer            | Standard or Parallel Arm | 689   |    |
| 2 Mop Plate              | K1050 8" high BEV CSK    | US32D | RO |
| 2 Kick Plate             | K1050 16" high BEV CSK   | US32D | RO |
| 2 Electromagnetic Holder | reuse existing           |       |    |
| 1 Gasketing              | S773BL                   | PE    |    |
| 1 Astragal               | S772BL                   | PE    |    |

**Set: NRHS - 12.0**

Doors: 140AC

|                    |                          |       |    |
|--------------------|--------------------------|-------|----|
| 1 Continuous Hinge | Full Mortise             | CL    |    |
| 1 Storeroom Lock   | ML2057 NSA CT6SD         | 630   | RU |
| 1 Permanent Core   | Medeco X4                | 26    | MC |
| 1 Door Closer      | Standard or Parallel Arm | 689   |    |
| 1 Mop Plate        | K1050 8" high BEV CSK    | US32D | RO |
| 1 Kick Plate       | K1050 16" high BEV CSK   | US32D | RO |
| 1 Gasketing        | S773BL                   |       | PE |

**Set: NRHS - 06.0**

Doors: 140E

|                           |                                       |       |    |
|---------------------------|---------------------------------------|-------|----|
| 2 Continuous Hinge        | Full Mortise                          | CL    |    |
| 1 Flush Bolt              | 2845                                  | US26D | RO |
| 1 Dust Proof Strike       | 570                                   | US26D | RO |
| 1 Classroom Intruder Lock | ML2002 NSA M19N CT6SD                 | 630   | RU |
|                           | x 1303-118 inside                     |       |    |
| 2 Permanent Core          | Medeco X4                             | 26    | MC |
| 1 Coordinator             | 2600 Series x mtg, brkts. as required | Black | RO |
| 2 Door Closer             | Standard or Parallel Arm              | 689   |    |
| 2 Mop Plate               | K1050 8" high BEV CSK                 | US32D | RO |
| 2 Kick Plate              | K1050 16" high BEV CSK                | US32D | RO |
| 2 Door Stop               | 400 / 441CU                           | US26D | RO |
| 1 Gasketing               | S773BL                                |       | PE |
| 1 Astragal                | S772BL                                |       | PE |

**Set: NRHS - 7.0**

Doors: 140G, 140H, 140J, 140K

|                         |                            |       |     |
|-------------------------|----------------------------|-------|-----|
| 2 Continuous Hinge      | PBB CG31                   |       |     |
| 2 Flush Bolts           | (see description)          | US26D | TRI |
| 1 Deadbolt              | MS1850 x SP28              |       | AR  |
| 2 Masterkeyed Cylinder+ | Corbin (to match existing) | US26D |     |
| 2 Push Pulls            | 1747-1                     | US32D | TRI |
| 2 Surface Closers       | 8916-SDS                   | 689   |     |
| 1 Weatherstripping      | 429A (jambs/head )         |       |     |
| 1 Astragal              | 326A x 326A                |       | ZE  |
| 2 Door Bottom           | 8193A                      |       | ZE  |
| 1 Saddle                | (as detailed)              |       | ZE  |

**Set: IEY - 14.0**

Doors: 145A

|                     |                          |       |    |
|---------------------|--------------------------|-------|----|
| 2 Continuous Hinge  | Full Mortise             | CL    |    |
| 2 Dust Proof Strike | 570                      | US26D | RO |
| 2 Flush Bolt        | 555                      | US26D | RO |
| 1 Storeroom Lock    | ML2057 NSA CT6SD         | 630   | RU |
| 2 Door Closer       | Standard or Parallel Arm | 689   |    |
| 2 Mop Plate         | K1050 8" high BEV CSK    | US32D | RO |
| 2 Kick Plate        | K1050 16" high BEV CSK   | US32D | RO |
| 2 Door Stop         | 400 / 441CU              | US26D | RO |
| 1 Gasketing         | S773BL                   |       | PE |
| 1 Astragal          | S772BL                   |       | PE |

**Set: WBW - 20.0**

Doors: G19A

|                                               |                          |       |     |
|-----------------------------------------------|--------------------------|-------|-----|
| 2 Continuous Hinge                            | Full Mortise             | CL    |     |
| 2 Exit Device (surface vertical rod, passage) |                          |       | 630 |
| 2 Door Closer                                 | Standard or Parallel Arm | 689   |     |
| 2 Drop Plate                                  | as required              | 689   |     |
| 2 Mop Plate                                   | K1050 8" high BEV CSK    | US32D | RO  |
| 2 Kick Plate                                  | K1050 8" high BEV CSK    | US32D | RO  |
| 2 Door Stop                                   | 400 / 441CU              | US26D | RO  |
| 1 Gasketing                                   | S773BL                   |       | PE  |
| 1 Astragal                                    | S772BL                   |       | PE  |

**Set: WBW - 19.0**

Doors: C2

|                              |                          |       |    |
|------------------------------|--------------------------|-------|----|
| 1 Continuous Hinge           | Full Mortise             | CL    |    |
| 1 Exit Device (rim, passage) |                          | 630   |    |
| 1 Door Closer                | Standard or Parallel Arm | 689   |    |
| 1 Mop Plate                  | K1050 8" high BEV CSK    | US32D | RO |
| 1 Kick Plate                 | K1050 16" high BEV CSK   | US32D | RO |
| 1 Electromagnetic Holder     | reuse existing           |       |    |
| 1 Gasketing                  | S773BL                   |       | PE |

**Set: WBW - 21.0**

Doors: G19B

|                           |                       |    |
|---------------------------|-----------------------|----|
| 2 Continuous Hinge        | By Storefront Mfr     |    |
| 1 Cylinder Lock           | Prepped for Medeco X4 |    |
| 2 Pull Bar                | By Storefront Mfr     |    |
| 2 Exit Device             | FALXCON 1790 Rim      |    |
| 1 Threshold               | By Storefront Mfr     | AL |
| 1 Keyed Removable Mullion | By Storefront Mfr     |    |
| 1 Sweep                   | By Storefront Mfr     |    |

**Set: HRHS - 13.0**

Doors: 1315A, 1315B, 1317, 1320

|             |         |   |    |
|-------------|---------|---|----|
| 1 Threshold | 656-223 | A | ZE |
|-------------|---------|---|----|

**Set: IEY - 16.0**

Doors: 146A

|                    |                          |       |    |
|--------------------|--------------------------|-------|----|
| 1 Continuous Hinge | Full Mortise             | CL    |    |
| 1 Storeroom Lock   | ML2057 NSA CT6SD         | 630   | RU |
| 1 Permanent Core   | Medeco X4                | 26    | MC |
| 1 Door Closer      | Standard or Parallel Arm | 689   |    |
| 1 Mop Plate        | K1050 8" high BEV CSK    | US32D | RO |
| 1 Kick Plate       | K1050 16" high BEV CSK   | US32D | RO |
| 1 Gasketing        | S773BL                   |       | PE |

END OF SECTION 087100

## SECTION 088000 - GLAZING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Windows.
  - 2. Doors.
  - 3. Storefront framing.
  - 4. Glazed entrances.
  - 5. Glazed interior walls.
  - 6. Borrowed lites.

#### 1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

#### 1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.



## 1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review temporary protection requirements for glazing during and after installation.

## 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturers of insulating-glass units with sputter-coated, low-E coatings.
- B. Product Certificates: For glass.
- C. Product Test Reports: For insulating glass and glazing sealants, for tests performed by a qualified testing agency.
  - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

## 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
  - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

#### 1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C.)

#### 1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.
- D. Manufacturer's Special Warranty on Double Glazing Units with Clear Gel Fill: Manufacturer agrees to replace units that deteriorate within specified warranty period. Deterioration of double glazing units with clear gel fill is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning glass contrary to manufacturer's written instructions. Evidence of failure is the leakage of gel fill from units, air bubbles within units, or obstruction of vision by contamination or deterioration of gel.
1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
    - a. Wind Design Data:
      - 1) Basic Wind Speed = 123 mph.
      - 2) Risk Category = III
      - 3) Wind Exposure = B
      - 4) Internal Pressure Coefficient = +/- 0.55.
  2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

- E Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
  2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
  3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K.)
  4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
  5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

## 2.2 GLASS PRODUCTS, GENERAL

- A Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: "Glazing Manual."
  2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- E Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.3 GLASS PRODUCTS

- A Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

## 2.4 LAMINATED GLASS

- A Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
  - 1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
  - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
  - 3. Interlayer Color: Clear unless otherwise indicated.

## 2.5 INSULATING GLASS

- A Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
  - 1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
  - 2. Spacer: Aluminum with mill or clear anodic finish.
  - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

## 2.6 FIRE-PROTECTION-RATED GLAZING

- A Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.
  - 1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.

- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F (250 deg C) temperature-rise limitation; and the fire-resistance rating in minutes.
- C. Double Glazing Units with Clear Gel Fill: Double glazing units made from two lites of uncoated, fully tempered, ultraclear float glass; with a perimeter edge seal enclosing a cavity filled with optically clear, intumescent gel; and complying with 16 CFR 1201, Category II.

## 2.7 GLAZING ACCESSORIES

- A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
  - 1. Sealants shall have a VOC content of 250 g/L or less.
  - 2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- D. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- E. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

- F. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- G. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- H. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- I. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

## 2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
  - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
    - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Grind smooth and polish exposed glass edges and corners.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep systems.
  - 3. Minimum required face and edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.



### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### 3.4 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### 3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.6 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

### 3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### 3.8 GLASS SCHEDULE

A. Glass Type 01: Insulated Glazing Unit.

1. Basis-of-Design Product: PPG Industries Solarban 60.
2. Overall Unit Thickness: 1 inch (25 mm.)
3. Outdoor Lite: Low-E-coated, clear laminated glass with two plies of heat-strengthened float glass.
  - a. Minimum Thickness of Each Glass Ply: 3 mm.
  - b. Interlayer Thickness: 0.030 inch (0.76 mm.)
4. Interspace Content: Air.
5. Indoor Lite: Clear laminated glass with two plies of heat-strengthened float glass.
  - a. Minimum Thickness of Each Glass Ply: 3 mm.
  - b. Interlayer Thickness: 0.030 inch (0.76 mm.)
6. Low-E Coating: Sputtered on second surface.
7. Winter Nighttime U-Factor: 0.0.29 maximum.
8. Summer Daytime U-Factor: 0.27 maximum.
9. Visible Light Transmittance: 70 percent minimum.
10. Solar Heat Gain Coefficient: 0.37 maximum.
11. Provide safety glazing labeling.

B. Glass Type 02: Fire-Protection-Rated Glass.

1. Basis-of-Design Product: Subject to compliance with requirements, provide SAFTI FIRST Fire Rated Glazing Solutions; SuperLite II-XL or equal.
2. 20-minute, 45-minute and 60-minute fire-protection-rated glazing with 450 deg F (250 deg C) temperature-rise limitation; double glazing units with clear gel fill.
3. Glass rating based on wall or door rating.

C. Glass Type 03: Insulating Security Glazing Unit.

1. Basis-of-Design Product: Armoured One LLC AOTSG1IGU
2. Overall Unit Thickness: 1 inch (25 mm.)
3. Outdoor Lite: Low-E-coated, Guardian SN68 heat-strengthened glass.
  - a. Minimum Thickness of Glass Ply: 6 mm.
4. Interspace Content: Air.
5. Indoor Lite: Clear laminated
  - a. Minimum Thickness of Each Glass Ply: 3 mm.
6. Low-E Coating: Guardian SN68 second surface.
7. Winter Nighttime U-Factor: 0.0.29 maximum.

8. Summer Daytime U-Factor: 0.28 maximum.
9. Visible Light Transmittance: 68 percent minimum.
10. Solar Heat Gain Coefficient: 0.38 maximum.
11. ASTM C1172 – Standard Specification for Laminated Architectural Flat Glass
12. Provide safety glazing labeling.
13. WEY-SA-C3 – Standard for shooter/attack certification and forced entry class 3.
14. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
15. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
16. UL972 – Standard for Burglary Resisting Glazing.
17. EN356 P4 – Testing and Classification of Resistance Against Manual Attack.
18. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
19. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
20. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

D. Glass Type 04: Clear laminated security glass.

1. Basis-of-Design Product: Armoured One LLC AOTSG416L
2. Overall Unit Thickness: 1/4 inch
3. ASTM C1172 – Standard Specification for Laminated Architectural Flat Glass
4. WEY-SA-C1 – Standard for shooter/attack certification and forced entry class 1.
5. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
6. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
7. UL972 – Standard for Burglary Resisting Glazing.
8. EN356 P4 – Testing and Classification of Resistance Against Manual Attack.
9. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
10. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety
11. Commission; current edition.
12. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
13. Refer to Section 081416 Flush Wood Doors, paragraph 2.4 D for lite kit information.

E Glass Type 05: Fire-Protection-Rated Security Glass.

1. Basis-of-Design Product: Armoured One LLC AOTSG516FR or AOTSG1016FR depending on the Fire Rating required for the glazing.
2. Overall Unit Thickness: 5/16 inch or 5/8 inch depending on the Fire Rating required for the glazing.
3. Tested in accordance with NFPA 80, NFPA 252, UL 9, UL 10B, UL 10C.
4. WEY-SA-C2 – Standard for shooter/attack certification and forced entry class 2.
5. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
6. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
7. UL972 – Standard for Burglary Resisting Glazing.
8. EN356 P4 – Testing and Classification of Resistance Against Manual Attack.
9. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
10. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
11. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
12. Refer to Section 081416 Flush Wood Doors, paragraph 2.4 D for lite kit information.

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## SECTION 090160 – CLEANING AND PATCHING MINOR CHIPS AND CRACKS IN TERRAZZO

### 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. The work of this Section consists of the provision of all plant, materials, labor, and equipment and the like necessary and/or required for the complete execution of all maintenance, restoration of terrazzo floors and provides guidance on repairing small cracks by patching with epoxy resin or cement grout as required by this section, schedules, keynotes and drawings. The procedures include general guidelines offered by GSA (Government Services Administration) and identifies specific design issues and outlines recommended solutions that have the least visual or physical impact on the historic materials.
  - 1. Minor chips and cracking in terrazzo require patching ONLY when surface irregularities present safety hazards or when it is necessary to prevent further deterioration to the terrazzo.
- B. These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the State Historic Preservation Officer (SHPO).

#### 1.3 REFERENCES

- A. NTMA Standards: Comply with specified provisions and recommendations of the National Terrazzo and Mosaic Association, Inc. (NTMA), <http://www.ntma.com/>.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. ProSoCo, Inc. Lawrence, KS.



- B. BASF Corporation, Florham Park, NJ.

## 2.2 MATERIALS

### A. Cement Grout Patching

1. Portland Cement: ASTM C150, Type I, except as modified to comply with NTMA requirements for compressive strength.
  - a. Obtain cement from a single source for each required color.
  - b. Provide non-staining white cement for terrazzo matrix.
2. Sand: ASTM C33.
3. Clean, potable water.
4. Aggregate: Natural, sound, crushed marble chips that do not include excessive flats or flakes, complying with NTMA requirements.
  - a. Colors and gradation of aggregate sizes as required to match original existing intact materials and patterns.
  - b. Aggregate colors should be matched after cleaning or taken from the interior of core samples depending upon scope of work.
5. Matrix Pigments: Pure mineral or synthetic pigments, resistant to alkalis and non-fading. Mix pigments with matrix to provide required colors.
6. Curing Compound: Liquid-membrane-forming compound, ASTM C309, Type 1.
7. Grout: A cement acrylic grout with color added to match the matrix of the original terrazzo.
  - a. Interior Floor Sealer: Colorless, slip and stain resistant penetrating sealer with a Ph factor between 7 and 10, which will not affect color or physical properties of terrazzo surface.
8. Plastic Sheeting
9. Equipment
  - a. Grinding Stones: Fine grit emery stones manufactured specifically for restorative type grinding and surfacing of terrazzo surfaces (#40 and #80 grit stones).
  - b. Power saw or hand tools.
  - c. Resurfacing Screens: A fine grit screen manufactured specifically for restorative type grinding and resurfacing terrazzo surfaces.

### B. Epoxy Patching

1. Patching Resin: Manufacturer's standard 2-component epoxy resin, designed specifically for patching of terrazzo materials.
  - a. Tint to match color of existing terrazzo matrix following manufacturer's recommendations.

2. Aggregate for Epoxy: Natural, sound, crushed marble chips without excessive flats or flakes, complying with NTMA requirements.
  - a. Colors and gradation of aggregate sizes as required to match existing terrazzo aggregate material.
3. Aggregate colors should be matched after cleaning or taken from the interior of core sample depending upon scope of work.
4. Ammonia or chemical stripper.
5. Interior Floor Sealer: Colorless, slip and stain resistant penetrating sealer with Ph factor between 7 and 10, that does not affect color or physical properties of terrazzo surface.
6. Clean, potable water.
7. Equipment
  - a. Hand sander, small grinding tools
  - b. Grinding stones: Fine grit emery stones manufactured specifically for restorative type grinding and surfacing of terrazzo surfaces (#40 and #80 grit stones).
  - c. Resurfacing Screens: A fine grit screen manufactured specifically for restorative type grinding and resurfacing terrazzo surfaces.

C. Cleaning

1. Cleaner: Liquid, neutral chemical cleaner, with pH factor between 7 and 10 of formulation recommended by sealer manufacturer for type of terrazzo used, and complying with NTMA requirements, such as Sure Klean 859 (ProSoCo, Inc.), or approved equal.
2. Interior Floor Sealer: Colorless, slip and stain resistant penetrating sealer with Ph factor between 7 and 10, that does not affect color or physical properties of terrazzo surface.
3. Compound Cleaner: A mildly abrasive phosphate free cleaning compound containing no caustic or harsh fillers, manufactured specifically for restorative type cleaning of terrazzo surfaces, such as "Wyandotte Detergent" (BASF-Wyandotte Corporation) or approved equal.  
-OR-
4. Sure Klean Grout and Tile Cleaner (ProSoCo, Inc.), or approved equal.
5. Clean, potable water.
6. Equipment
  - a. Wet vac.
  - b. Paint roller.
  - c. Low pressure tank sprayer.
  - d. Power scrubber with scrub brush attachment.
  - e. Stiff bristle brushes (natural or nylon bristle).

## PART 3 - EXECUTION

### 3.1 CEMENT GROUT PATCHING

#### A. Preparation

1. With a power saw or hand tools, cut a vertical perimeter wall around the area to be patched. If the patch is smaller than an inch square, slightly undercut this edge.
2. Clean all debris from surface.
3. Saturate void with water to prevent quick surface drying. Ensure that water penetrates the surface to achieve a proper bond.
4. Clean surfaces until any obstructing material has been removed.
5. Apply cement paste and work into the surface. Do not allow cement paste to dry before placing terrazzo composition.

#### B. Installation and Application

1. NOTE: Match marble chips and matrix for existing terrazzo by size, mineral content, and color. Colors should be matched after cleaning or matched with samples taken from the interior of core samples, depending upon scope of work.
2. Mix two parts blended marble chips with one part Portland cement and add enough water to make the mixture plastic.
3. Place mixture over chip or crack and level with a trowel.
4. Seed additional marble chips of the same blend over the patch, as required to establish a uniform coverage.
5. Compact patch, removing all excess water and cement from the surface.
6. Cover the patch with paper or polyethylene sheeting to prevent quick hydration.
7. Cure until topping develops sufficient strength to prevent lifting or pulling of terrazzo chips during grinding.
8. Sand surface with a hand sander or small grinding tool, using fine stones to achieve desired finish.
  - a. Use a #40 or finer grit stone for the initial grinding, exposing the marble chips. Follow with a #80 grit stone before grouting with cement to fill all pinholes.
9. CAUTION: IF DIVIDER STRIPS ARE COATED INSTEAD OF SOLID COMPOSITION, THEY SHOULD NOT BE GROUND. GRINDING MAY CAUSE COATED DIVIDER STRIPS TO LOSE THEIR COATING AND DISCOLOR.
10. Cover grouted surface with paper or polyethylene for at least 72 hours.
11. Thoroughly rinse the surface with clean, clear water.
12. Remove excess rinse water

13. Apply grout by hand or with a machine, using identical Portland cement, color and pigments as were used in topping, taking care to fill all voids completely.
14. Final polish with a #80 or finer grit stone. Care should be taken to limit grinding and polishing to a small distance beyond the perimeter of the patch.
15. Seal patch with a penetrating-type terrazzo sealer.

### 3.2 EPOXY PATCHING

#### A. Preparation

1. Remove all foreign matter from the void, followed by routing with a power tool. Remove all sealer from the surface adjacent to the void with a stripper or ammonia.
2. Blend the resin materials to match the color matrix, by adding marble dust or pigment.

#### B. Installation and Application

1. Force mixed resin into the void, making sure it is pressured into the crack as deep as possible. In some cases, the supplier will instruct using a primer for their materials.
2. If the void is large enough, and the intent is to disguise the line so it will blend into the rest of the terrazzo floor, irregularly place marble chips matching the existing terrazzo blend along the line approximately one to two inches on center. Be sure to do this, however, while the patching resin is still in a wet state. Finally, tool off surface and allow to cure.
3. When the material has hardened, sand surface with a hand sander or small grinding tool, using fine stones.
  - a. Use a #40 or finer grit stone for the initial grinding, exposing the marble chips. Follow with a fine #80 grit stone before grouting with cement to fill all pinholes.
  - b. CAUTION: DIVIDER STRIPS MAY BE COATED INSTEAD OF SOLID COMPOSITION. COATED STRIPS SHOULD NOT BE GROUND. GRINDING MAY CAUSE COATED DIVIDER STRIPS TO LOSE THEIR COATING AND DISCOLOR.
4. Cover grouted surface with paper or polyethylene for at least 72 hours.
5. Thoroughly rinse the surface with clean, clear water.
6. Remove excess rinse water and allow to dry.
7. Final polish with a #80 or finer grit stone. Care should be taken to limit grinding and polishing to a small distance beyond the perimeter of the patch.

### 3.3 STRIPPING AND CLEANING

- A. Perform a thorough examination of the existing conditions. Perform any necessary tests on an inconspicuous surface to determine the current conditions and appropriate steps and materials necessary for stripping terrazzo surfaces.
- B. Installation and Application (The following procedure calls for stripping the floor down to the original surface, cleaning if necessary, and then sealing with a long-lasting sealer.)
  - 1. Strip existing sealers and coatings from floor:
    - a. Apply chemical floor cleaner with paint roller and let stand for five to ten minutes. Work in areas no more than four feet wide to ensure that the applicator is always standing on a dry floor.
    - b. Using a low-pressure tank sprayer, apply a mist of water over the cleaner already on the floor. The water will emulsify the old sealer and dilute the thixotropic cleaner.
    - c. Pick up all remaining residues with a wet vac.
    - d. Using a power scrubber with a scrub brush attachment, scrub the floor until all coating material has been removed.
    - e. Pick up all liquid residues with a wet vac.
    - f. Pick up all remaining liquid residues with a wet vac and allow to dry.

-OR-
  - 2. If dirt and scratches have become so severe that normal stripping and cleaning no longer restore the floor to its original luster, the surface may be stripped using fine grit stones and resurfacing screens. CAUTION: This method of removing sealers and coatings involves grinding off a thin layer of the terrazzo. It should only be used as an extreme measure and a terrazzo specialist must be engaged.
  - 3. If the floor is still dirty, clean using Sure Klean Grout and Tile Cleaner (ProSoCo, Inc.), or approved equal.
    - a. Dilute three to four parts water to one part Grout and Tile Cleaner.
    - b. Pre-wet area to be cleaned.
    - c. Apply cleaning solution with floor scrub brushes.
    - d. Let stand two to three minutes while lightly agitating with a stiff, natural bristle brush, broom, or nylon brush.
    - e. Thoroughly rinse the surface with clean, clear water.
    - f. Pick up all remaining liquid residues with a wet vac and allow to dry.
    - g. Seal the terrazzo surface with high strength sealer according to manufacturer's instructions

### 3.4 PREVENTIVE MAINTENANCE AND CLEANING

#### A. Materials

1. Cleaning compounds used on terrazzo should be free from alkalides, acids, or other strong ingredients which can permanently damage the floor.
2. Avoid acids and washing solutions containing carbonates or trisodium phosphate.
3. DO NOT USE sweeping compounds containing oil, sand, or abrasives.
4. The floor must be carefully rinsed after cleaning.
5. All cleaning solution and rinse water must be picked up, by squeegee, mop, or wet-dry vacuum, to prevent slipperiness.
6. DO NOT USE soaps and scrubbing powders containing water soluble, inorganic salts, or crystallizing salts in the maintenance of terrazzo.
7. The cleaning cycle should be regulated by the amount of traffic.
8. For general cleaning, use a neutral cleaning compound diluted in accordance with the manufacturer's directions.
  - a. For very dirty areas, increase the amount of compound.

#### B. Application

1. The floor should be pre-wet with clean, warm water before beginning the washing operation.
2. A mop dressing used for daily sweeping should be NON-OILY; Sweeping compounds containing oil will penetrate and permanently discolor terrazzo.
3. Sweeping compounds containing sand are difficult to sweep up and may abrade the surface if left on the floor (wax-treated dust mops and sweeping compounds are good).
4. Electric- or battery-powered scrubbing machines should be used periodically with a solution of neutral compound to loosen dirt.
5. Floor machines should be equipped with fiber brushes, or with abrasive nylon pads.
6. Buffing the floor with a powered machine after each cleaning restores the luster to the surface, building a natural sheen.
7. Steel wool SHOULD NOT be used on terrazzo; It may rust and stain the surface.
8. Terrazzo floors containing abrasive aggregates SHOULD NEVER be sealed; They should be scrubbed regularly to keep them free of build-up of dirt and other foreign matter

### 3.5 WASTE MANAGEMENT

#### A. Coordinate with Division 01

1. Separate and recycle cut-offs and waste materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
2. Set aside and protect materials suitable for reuse and/or remanufacturing.
3. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

END OF SECTION 090160

## SECTION 092216 - NON-STRUCTURAL METAL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
  - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For dimpled steel studs and runners, firestop tracks, from ICC-ES.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.



## 2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
  - 2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
  - 1. Steel Studs and Runners:
    - a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm) (20 gage.)
    - b. Depth: As indicated on Drawings.
  - 2. Dimpled Steel Studs and Runners:
    - a. Minimum Base-Metal Thickness: 0.025 inch (0.64 mm) (20 gage equivalent.)
    - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide the following:
  - 1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. Basis-of-Design Product: Subject to compliance with requirements, provide Clark Dietrich Building Systems; SLP-TRK Slotted Deflection Track or equal.
- D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Fire Trak Corp; Fire Trak System attached to studs with Fire Trak Posi Klip or equal.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: 0.033-inch (0.84 mm).
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: 0.033-inch (0.84 mm) (20 gage).

2. Depth: As indicated on Drawings.

## 2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch (1.59 mm) diameter wire, or double strand of 0.048-inch (1.21 mm) diameter wire.
- B. Hanger Attachments to Concrete:
  1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
    - a. Type: Post-installed, chemical anchor or Post-installed, expansion anchor.
  2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053-inch (1.34 mm) and minimum 1/2-inch (13 mm) wide flanges.
  1. Depth: 1-1/2 inches (38 mm).
- E. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armstrong World Industries, Inc; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; Drywall Grid System.
    - c. United States Gypsum Company; Drywall Suspension System.

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

- B. Isolation Strip at Exterior Walls: Provide one of the following:
  - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
- B. Coordination with Sprayed Fire-Resistive Materials:
  - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) on center.
  - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

#### 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13 mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
  - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

- E. Direct Furring:
  - 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) on center.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8-inch (3 mm) from the plane formed by faces of adjacent framing.

### 3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  - 1. Hangers: 48 inches (1219 mm) on center.
  - 2. Carrying Channels (Main Runners): 48 inches (1219 mm) on center.
  - 3. Furring Channels (Furring Members): 16 inches (406 mm) on center.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within.
  - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 4. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  - 5. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

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## SECTION 092900 - GYPSUM BOARD

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Interior gypsum board.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
  - 1. Trim Accessories: Full size Sample in 12 inch (300 mm) long length for each trim accessory indicated.

#### 1.4 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Install mockups for the following:
    - a. Each level of gypsum board finish indicated for use in exposed locations.
  - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
  - 3. Simulate finished lighting conditions for review of mockups.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.



## 1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
  - 1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

### 2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

## 2.3 INTERIOR GYPSUM BOARD

- A. Basis-of-Design Product: Subject to compliance with requirements, provide National Gypsum Company; products or a comparable product by one of the following:
  - 1. CertainTeed Corporation.
  - 2. Georgia-Pacific Building Products.
  - 3. United States Gypsum Company.
- B. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
  - 1. Thickness: 5/8 inch (15.8 mm).
  - 2. Long Edges: Tapered.
  - 3. Product: Gold Bond Fire-Shield Gypsum Board – Type C.
- C. Gypsum Wall Board: ASTM C 1396/C 1396M.
  - 1. Thickness: 5/8 inch (15.8 mm).
  - 2. Long Edges: Tapered.
  - 3. Product: Gold Bond Fire-Shield Gypsum Board – Type X.

## 2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
  - 2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.

## 2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
  - 2. Glass-Mat Gypsum Sheathing Board: 10 by 10 glass mesh.
  - 3. Tile Backing Panels: As recommended by panel manufacturer.

- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Pre-filling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
  - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

## 2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  - 1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24.)
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Pecora Corporation.
2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24.)

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
  2. Fit gypsum panels around ducts, pipes, and conduits.
  3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch (6.4 to 9.5 mm) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch (6.4 to 12.7 mm) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
  3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

- B. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations, and temporarily brace or fasten gypsum panels until fastening adhesive has set.

### 3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings, according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.
  - 2. Bullnose Bead: Use where indicated.
  - 3. LC-Bead: Use at exposed panel edges.
  - 4. L-Bead: Use where indicated.

### 3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Pre-fill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
  - 4. Level 5: Where indicated on Drawings.

### 3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

## SECTION 095113 – ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.
- C. Samples for Initial Selection: For components with factory-applied color finishes.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.



## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
  - 2. Smoke-Developed Index: 450 or less.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

### 2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations:
  - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.

2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
  1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.
- E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
  1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

## 2.3 ACOUSTICAL PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc., products, or a comparable product by one of the following:
  1. BPB USA.
  2. USG
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
  1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
  2. Pattern: CE (perforated; small holes and lightly textured.)
- C. Acoustical Ceiling Tiles [ACT-1]: Match existing Size, Texture, Color, and Thickness.
- D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no

mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

## 2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
- B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
  - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
    - a. Type: Post-installed expansion anchors.
    - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
    - c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
    - d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than 0.135-inch (3.5mm) diameter wire.
- E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Angle Hangers: Angles with legs not less than 7/8-inch (22 mm) wide; formed with 0.04-inch (1 mm) thick, galvanized-steel sheet complying with ASTM A 653/A 653M,

G90 (Z275) coating designation; with bolted connections and 5/16-inch (8 mm) diameter bolts.

- G. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

## 2.5 METAL SUSPENSION SYSTEM Type 1

- A. Manufacturers: Subject to compliance with requirements:

- 1. Basis of Design: Armstrong World Industries, Inc.
- 2. BPB USA.
- 3. USG

- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished 15/16 inch (24 mm) wide metal caps on flanges.

- 1. Structural Classification: Heavy-duty system.
- 2. End Condition of Cross Runners: Override (stepped) type.
- 3. Face Design: Flat, flush.
- 4. Cap Material: Steel cold-rolled sheet.
- 5. Cap Finish: Painted white.
- 6. Product: Armstrong Prelude XL 15/16".

## 2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

- 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
- 2. For lay-in panels with reveal edge details, provide stepped edge molding those forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
- 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

- B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
  - 1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.
  - 2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 3. Product: Armstrong Axiom – Classic Trim.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

#### 3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  7. Do not attach hangers to steel deck tabs.
  8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
  10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw-attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
  - 1. Arrange directionally patterned acoustical panels as follows:
    - a. As indicated on reflected ceiling plans.
  - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
  - 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  - 4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
  - 5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

#### 3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

## SECTION 096513 - RESILIENT BASE AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Resilient base.
  - 2. Resilient flooring accessories, including transition strips.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.
- E. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.



## 1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Coordinate mockups in this Section with mockups specified in other Sections.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

## 1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 THERMOPLASTIC-RUBBER BASE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite; A Tarkett Company, or a comparable product by one of the following:
  - 1. Roppe Corporation, USA
  - 2. Burke Mercer Flooring Products; a division of Burke Industries Inc.
  - 3. Armstrong World Industries, Inc.
- B. Product Standard: ASTM F 1861, Traditional (rubber).

1. Group: I (solid, homogeneous).
2. Style and Location:
  - a. Style A, Straight: Provide in areas with carpet.
  - b. Style B, Cove: Provide in areas with resilient flooring.
- C. Thickness: 0.125 inch (3.2 mm).
- D. Height: 4 inches (102 mm).
- E. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Job formed or preformed.
- H. Colors: As selected by Architect from full range of industry colors.

## 2.2 ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite; A Tarkett Company, or a comparable product by one of the following:
  1. Roppe Corporation, USA
  2. Burke Mercer Flooring Products; a division of Burke Industries Inc.
  3. Armstrong World Industries, Inc.
- B. Product Standard: ASTM F 1861, Traditional (rubber).
  1. Group: I (solid, homogeneous).
  2. Style and Location:
    - a. Style A, CTA-H: Provide at Carpet / Resilient transitions.
    - b. Style B, CTA-Y: Provide at Resilient / Resilient transitions.
- C. Lengths: Cut lengths 144 inches (1219 mm) long or coils in manufacturer's standard length.
- D. Adhesive: Per manufacturer recommendations.
- E. Colors: As selected by Architect from full range of industry colors

## 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
  - 1. Provide under all components to provide for smooth finish appearance.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
  - 1. Adhesives shall have a VOC content of 50 g/L or less except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations.
  - a. Perform relative humidity test using in situ probes according to ASTM F 2170.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
  1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
    - a. Miter or cope corners to minimize open joints.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
  - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

## SECTION 096613 – PORTLAND CEMENT TERRAZZO FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Cast-in-place terrazzo floor.
- B. Divider strips.

#### 1.2 REFERENCE STANDARDS

- A. ASTM C33/C33M – Standard Specification for Concrete Aggregates; 2013.
- B. ASTM C150/C150M – Standard Specification for Portland Cement; 2015.
- C. NTMA (SPECS) – NTMA Terrazzo Specifications; current edition located at [www.ntma.com](http://www.ntma.com).

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I Normal; white color for topping mix; gray color for underbed; modified to NTMA higher compressive strength requirements; obtained from single source.
- B. Color Pigments for Topping: Non-fading mineral type, alkali-resistant.
- C. Terrazzo Sand: ASTM C33, fine aggregates.
- D. Water: Potable.
- E. Surface Aggregate: Type, color, and size to match existing.

#### 2.2 ACCESSORIES

- A. Divider Strips: 1/8-inch (3mm) thick zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.
- B. Control Joint Strips: 1/8-inch (3mm) nominal width zinc exposed top strips, zinc coated steel concealed bottom strip, 1/8-inch (3mm) wide neoprene filler strip between vertical strips, with anchoring features.

- C. Divider and Control Joint Strip Height: To suit thickness of terrazzo topping with allowance for grinding.
- D. Cleaner: Neutralizing liquid type pH of 7 to 10.

## 2.3 MIXES

- A. Underbed: One part Portland cement to 4 parts sand by volume. Add water to produce low slump mix.
- B. Floor: Comply with mix requirements of NTMA Plate No. as selected by Architect, white Portland cement, with exposed divider and accessory strips.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

### 3.2 PREPARATION

- A. Clean substrate of foreign matter.

### 3.3 APPLICATION – BONDED TERRAZZO

- A. Place cementitious underbed over wet slurry bond coat, to a nominal thickness of 1-1/4 inches (31 mm).
- B. Place divider strips and control joints at locations indicated and insert in semi-plastic uncured underbed. Install straight and level.
- C. Place terrazzo topping mix over prepared underbed to a nominal thickness of 5/8 inch (16 mm).

### 3.4 CLEANING

- A. Scrub and clean terrazzo surfaces with cleaner in accordance with NTMA instructions. Let dry.
- B. Seal and polish surfaces in accordance with NTMA instructions.

### 3.5 PROTECTION

- A. Do not permit construction traffic over finished terrazzo surfaces.

END OF SECTION 096613

## SECTION 096723 - RESINOUS FLOORING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes resinous flooring systems.
- B. Related Sections include the following:
  - 1. Division 07 Section "Joint Sealants" for sealants installed at joints in resinous flooring systems.
- C. System Description:
  - 1. The work shall consist of preparation of the substrate, the furnishing and application of a cementitious urethane based self-leveling seamless flooring system with quartz aggregate broadcast and Epoxy broadcast and topcoats.
  - 2. The system shall have the color and texture as specified by the Owner with a nominal thickness of 1/4-inch. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.
  - 3. Cove base to be applied where noted on plans and per manufacturers standard details unless otherwise noted.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. Samples for Initial Selection: For each type of exposed finish required.
- C. Samples for Verification: For each resinous flooring system required, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project. Color, texture, and thickness shall be representative of overall appearance of finished system.



- D. Product Schedule: Use resinous flooring designations indicated in Part 2 and room designations indicated on Drawings in product schedule.
- E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- F. Material Test Reports: For each resinous flooring component.
- G. Material Certificates: For each resinous flooring component, signed by manufacturer.
- H. Maintenance Data: For resinous flooring to include in maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: The Manufacturer shall have a minimum of 5 years of experience in the production, sales, and technical support or cementitious urethane, epoxy industrial flooring, quartz aggregate and related materials.
- B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
  - 1. Engage an installer who employs only persons trained and approved by resinous flooring manufacturer for applying resinous flooring systems indicated.
- C. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- D. A pre-installation conference shall be held between Applicator, General Contractor, and the Owner to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.
- E. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Apply full-thickness mockups on 48 inch (1200 mm) square floor area selected by Architect.
    - a. Include 48-inch (1200 mm) length of integral cove base.
  - 2. Simulate finished lighting conditions for Architect's review of mockups.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
- B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects, in accordance with manufacturer's written instructions.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
  1. Application may proceed while air, material and substrate temperatures are between 60 F and 85 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
  2. The relative humidity in the specific location of the application shall be less than 85% and the surface temperature shall be at least 5 F above the dew point.
  3. The Applicator shall ensure that adequate ventilation is available for the work area. This shall include the use of manufacturer's approved fans, smooth bore tubing and closure of the work area.
  4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.
- B. Conditions of new concrete to be coated with cementitious urethane material:
  1. Concrete shall be moisture cured for a minimum of three (3) days and have fully cured a minimum of five (5) days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.
  2. Concrete shall have a flat rubbed finish, float, or light steel trowel finish (a hard steel trowel finish is neither necessary nor desirable.)
  3. Sealers and curing agents should not be used.
  4. Concrete shall have minimum design strength of 3,500 psi and a maximum water/cement ratio of 0.45.
  5. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
2. "No Smoking" signs shall be posted at the entrances to the work area.
3. The Owner shall be responsible for the removal of foodstuffs from the work area.
4. Non-related personnel in the work area shall be kept to a minimum.

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

E. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 RESINOUS FLOORING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:

1. Basis of Design: Dur-A-Gard, Inc, Epoxy Coating with Urethane (Armor Top) TOPCOAT (35 mils.)
2. Or equal.

B. System Characteristics:

1. Color and Pattern: As selected by Architect from manufacturer's full range.
2. System Materials:
  - a. Topping: Dur-A-Flex, Inc, Poly-Crete MD resin, hardener, and SL aggregate.
  - b. The broadcast aggregate shall be Dur-A-Flex, Inc. Flintshot or Q-Rok quartz aggregate.
  - c. Broadcast: Dur-A-Flex, Inc. Shop Floor, epoxy based two-component resin.
  - d. Grout coat: Dur-A-Flex, Inc. Shop Floor, epoxy-based, two-component resin.
  - e. Top coat: Dur-A-Flex, Inc. Armor-Top aliphatic urethane multi-component resin.
3. Patch Materials
  - a. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Poly-Crete MD (up to 1/4 inch.)
  - b. Deep Fill and Sloping Material (over 1/4 inch): Use Dur-A-Flex, Inc. Poly-Crete WR.
4. Integral Cove Base: 4 inches (100 mm) high.

C. System Components: Manufacturer's standard components that are compatible with each other and as follows:

|    |                                              |                                                     |
|----|----------------------------------------------|-----------------------------------------------------|
| 1. | Topping                                      | Poly-Crete SL                                       |
| a. | Percent Reactive                             | 100 %                                               |
| b. | VOC                                          | 0 g/L                                               |
| c. | Bond Strength to Concrete ASTM D 4541        | 400 psi, substrates fails                           |
| d. | Compressive Strength, ASTM C579              | 7,250 psi                                           |
| e. | Tensile Strength, ASTM D 638                 | 750 psi                                             |
| f. | Flexural Strength, ASTM D 790                | 4,400 psi                                           |
| g. | Impact Resistance @ 125 mils, MIL D-3134,    | 160 inch lbs;<br>No visible damage or deterioration |
| 2. | Broadcast and Grout Coat                     | Shop-Floor™ Resin                                   |
| a. | Percent Reactive,                            | 100 %                                               |
| b. | VOC                                          | 8 g/L                                               |
| c. | Water Absorption, ASTM D 570                 | 0.04 %                                              |
| d. | Tensile Strength, ASTM D 638                 | 4,000 psi                                           |
| e. | Coefficient of thermal expansion ASTM D 696, | $2 \times 10^{-5}$ in/in/F                          |
| f. | Flammability ASTM D-635                      | Self-Extinguishing                                  |
| g. | Flame Spread/ NFPA 101 ASTM E-84             | Class A                                             |
| 3. | Topcoat                                      | Armor Top                                           |
| a. | VOC                                          | 0 g/L                                               |
| b. | 60 Degree Gloss ASTM D523                    | 75+/-5                                              |
| c. | Mixed Viscosity, (Brookfield 25°C)           | 500 cps                                             |
| d. | Tensile strength, ASTM D 638                 | 7,000 psi                                           |
| e. | Abrasion Resistance, ASTM D4060              | Gloss Satin;                                        |
|    | CS 17 wheel (1,000 g load) 1,000 cycles      | 4-8mg loss with grit,<br>10-12mg loss without grit  |
| f. | Pot life @ 70° F 50% RH                      | 2 hours                                             |
| g. | Dry properties, 70°F, 50% R.H.               | 8 hours tack free, 12 hours Dry                     |
|    | 60°F, 30% RH                                 | 12 hours tack free, 18 hours Dry                    |
|    | 80°F, 70%RH                                  | 4 hours tack free, 6 hours Dry                      |
|    | Full Chemical resistance                     | 7 days                                              |

## 2.2 ACCESSORY MATERIALS

A. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

- Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24.)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.
  - 1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

### 3.2 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- B. Existing Resinous Flooring Substrates: Provide 2-3 ounces of Superstick per mixed gallon of Dur-A-Guard for all applications over existing seamless flooring.
- C. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring. Provide surface finish recommended by coating manufacturer.
  - 1. Moisture Testing: Perform tests recommended by manufacturer and as follows.
    - a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 95% relative humidity level measurement.
    - b. If the relative humidity exceeds 95% then the Owner and/or Engineer shall be notified and advised of additional cost for the possible installation of a vapor mitigation system that has been approved by the manufacturer or other means to lower the value to the acceptable limit.
  - 2. Slab contaminant testing: Perform tests recommended by manufacturer and as follows:
    - a. Perform two (2) core sample analyses for the purpose of determining the level of possible contaminants in the concrete slab using Metrohm 850 Professional series Ion Chromatograph.
  - 3. Mechanical surface preparation
    - a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely

- removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.
- b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
  - c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4-inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
  - d. Cracks and joints (non-moving) greater than 1/8-inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.
- 4. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufacturer's recommendations.
  - 5. Roughen concrete substrates as follows:
    - a. Shot blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    - b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.
  - 6. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
  - E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
  - F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

### 3.3 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
  - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.

2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
  - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
  1. Cove Base Height: Apply cove base to a height of 4" AFF.
- C. Apply floor system with double broadcast method.
- D. System
  1. The system shall be applied in five distinct steps as listed below:
    - a. Substrate preparation.
    - b. Topping/overlay application with quartz aggregate broadcast.
    - c. Resin application with quartz aggregate broadcast.
    - d. Grout coat application.
    - e. Topcoat application.
  2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
  3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
  4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
  5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.
- E. Topping
  1. The topping shall be applied as a self-leveling system as specified by the Architect. The topping shall be applied in one lift with a nominal thickness of 1/8 inch.
  2. The topping shall be comprised of three components, a resin, hardener, and filler as supplied by the Manufacturer.
  3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. SL Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend.

4. The topping shall be applied over horizontal surfaces using 1/2 inch "v" notched squeegee, trowels, or other systems approved by the Manufacturer.
5. Immediately upon placing, the topping shall be degassed with a loop roller.
6. Quartz aggregate shall be broadcast to excess into the wet material at the rate of 0.8 lbs.sf.
7. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

F. Broadcast

1. The broadcast coat resin shall be applied at the rate of 90 sf./gal. (flintshot) or 50 sf./gal. (Q-Rok.)
2. The broadcast coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high-speed paddle mixer.
3. Quartz aggregate shall be broadcast into the wet resin at the rate of 0.5 lbs./sf.
4. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

G. Grout Coat

1. The grout coat shall be squeegee applied with a coverage rate of 90 sf./gal. (flintshot) or 50 sf./gal. (Q-Rok.)
2. The grout coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high-speed paddle mixer.
3. The grout coat will be back rolled and cross rolled to provide a uniform texture and finish.

H. Top Coat

1. The pigmented topcoat (Armor-Top) shall be roller applied with a coverage rate of 500 sf./gal.
2. The top coat will have a nominal thickness of 3/16 inch.

3.4 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:
  - a. Temperature.
2. Air, substrate temperatures and, if applicable, dew point.
  - a. Coverage Rates.
3. Rates for all layers shall be monitored by checking quantity of material used against the area covered.



### 3.5 CLEANING AND PROTECTING

- A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.
- B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.
- C. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

## SECTION 099100 – PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
  - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item, or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
  - 1. Painting includes field painting of exposed structural columns and related elements; exposed and bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
  - 1. Prefinished items include the following factory-finished components:
    - a. Architectural woodwork.
    - b. Visual display surfaces.
    - c. Toilet enclosures.
    - d. Metal lockers.
    - e. Aluminum window and doorframes.
    - f. Coiling overhead doors.
    - g. Impact resistant wall protection.
    - h. Operable panel partitions.
    - i. Storage shelving.
    - j. Finished mechanical and electrical equipment.
    - k. HVAC inlets and outlets.
    - l. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
  - a. Foundation spaces.
  - b. Furred areas.
  - c. Ceiling plenums.
  - d. Utility tunnels.
  - e. Pipe spaces.
  - f. Duct shafts.
  - g. Elevator shafts.
3. Finished metal surfaces include the following:
  - a. Anodized aluminum.
  - b. Stainless steel.
  - c. Chromium plate.
  - d. Copper and copper alloys.
  - e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
  - a. Valve and damper operators.
  - b. Linkages.
  - c. Sensing devices.
  - d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 05 Section "Structural Steel" for shop priming structural steel.
2. Division 05 Section "Metal Fabrications" for shop priming ferrous metal.
3. Division 05 Section "Pipe and Tube Railings" for shop priming railings.
4. Division 06 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
5. Division 08 Section "Hollow Metal Doors and Frames" for factory priming steel doors and frames.
6. Division 08 Section "Flush Wood Doors" for factory finishes to flush wood doors.

### 1.3 DEFINITIONS AND REFERENCES

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semi-gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.

- B. PDCA (Painting and Decorating Contractors of America) – Painting - Architectural Manual.
- C. SSPC (Steel Structures Painting Council) – Steel Structures Painting Manual.

#### 1.4 SUBMITTALS

- A. Product Data: For each paint system indicated. Include block fillers and primers.
  - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
  - 1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
  - 2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
  - 3. Submit Two (2) samples on the following substrates for Architect's review of color and texture only:
    - a. Ferrous Metal: 4-inch square samples of flat metal and 8-inch-long samples of solid metal for each color and finish.
    - b. Gypsum board and plaster: 12-inch square samples for each color and finish.
- C. Qualification Data: For Applicator.

#### 1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and each new and existing substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
  - a. Wall Surfaces: Provide samples on at least 100 sq. ft.
  - b. Small Areas and Items: Architect will designate items or areas required.
2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
  - a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
  - b. Refinish benchmark areas according to finish schedule prior to completion of Work following Architects direction and approval.
3. Final approval of finishes and colors will be from benchmark samples.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
  1. Product name or title of material.
  2. Product description (generic classification or binder type).
  3. Manufacturer's stock number and date of manufacture.
  4. Contents by volume, for pigment and vehicle constituents.
  5. Thinning instructions.
  6. Application instructions.
  7. Color name and number.
  8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F and a maximum of 90 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
  1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

#### 1.7 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

- C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
  - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

## 1.8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and, in the quantities, described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
  - 1. Quantity: Furnish Owner with extra paint materials in quantities indicated below:
    - a. Two full unopened gallons of each color applied.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Benjamin Moore & Co. (Benjamin Moore).
  - 2. Sherwin-Williams
  - 3. PPG Industries, Inc.

### 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Colors, textures and other physical characteristics of the final finish may be referenced by specification of a single manufacturer's numbering system. Match referenced materials.

## 2.3 CONCRETE UNIT MASONRY BLOCK FILLERS

- A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.
  1. Benjamin Moore; Moorcraft Super Craft Latex Block Filler No. 285: Applied at a dry film thickness of not less than 8.1 mils.
  2. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils.

## 2.4 EXTERIOR PRIMERS

- A. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
  1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. Z06: Applied at a dry film thickness of not less than 2.0 mils.
  2. Sherwin-Williams; Kem Bond HS Universal Metal Primer B50 Series: Applied at a dry film thickness of 2.0-2.5 mils.
- B. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.
  1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils.
  2. Sherwin-Williams; Pro-Cryl Universal Water Based Primer B66-310 Series: Apply at a dry film thickness of 2.0-4.0 mils.

## 2.5 INTERIOR PRIMERS

- A. Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.

1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.
  2. Sherwin-Williams; PrepRite Masonry Primer B28W300: Applied at a dry film thickness of not less than 3.0 mils.
- B. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.
  2. Sherwin-Williams; PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.6 mils.
- C. Interior Plaster Primer: Factory-formulated latex-based primer for interior application.
1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.
  2. Sherwin-Williams; PrepRite Masonry Primer B28W300 Series: Applied at a dry film thickness of not less than 3 mils.
- D. Interior Wood Primer for Acrylic-Enamel and Semigloss Alkyd-Enamel Finishes: Factory-formulated alkyd- or acrylic-latex-based interior wood primer.
1. Benjamin Moore; Fresh Start Alkyd Enamel Underbody and Primer Sealer No. 217: Applied at a dry film thickness of not less than 1.5 mils.
  2. Sherwin-Williams; PrepRite Classic Interior Primer B28W101 Series: Applied at a dry film thickness of not less than 1.6 mils.
- E. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. Z06: Applied at a dry film thickness of not less than 2.0 mils.
  2. Sherwin-Williams; Kem Bond HS Universal Metal Primer B50 Series: Applied at a dry film thickness of 3.0-8.0 mils.
- F. Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.
1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils.
  2. Sherwin-Williams; Pro-Cryl Universal Water Based Primer B66-310 Series: Applied at a dry film thickness of 5.0-10.0 mils.
- G. Interior Semigloss Epoxy Primer/Sealer: Factory-formulated semigloss epoxy primer/sealer for interior application.



1. Sherwin-Williams; ArmorSeal 33 Epoxy Primer/Sealer: Applied at a dry film thickness of not less than 8.0 mils.

## 2.6 EXTERIOR FINISH COATS

- A. Exterior Semi-gloss Acrylic Enamel: Factory-formulated semi-gloss waterborne acrylic-latex enamel for exterior application.
  1. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170: Applied at a dry film thickness of not less than 1.1 mils.
  2. Sherwin-Williams; A-100 Latex Gloss A8 Series: Applied at a dry film thickness of not less than 1.3 mils.
- B. Exterior Low-Luster Acrylic Paint: Factory-formulated low-sheen (eggshell) acrylic-latex paint for exterior application.
  1. Benjamin Moore; Moorcraft Super Spec Low Lustre Latex House Paint No. N185: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
  2. Sherwin-Williams; A-100 Exterior Latex Satin House & Trim Paint A82 Series: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).

## 2.7 INTERIOR FINISH COATS

- A. Interior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for interior application.
  1. Benjamin Moore; Moorcraft Super Spec Latex Flat No. 275: Applied at a dry film thickness of not less than 1.2 mils.
  2. Sherwin-Williams; ProMar 200 Interior Latex Flat Wall Paint B30W200 Series: Applied at a dry film thickness of not less than 1.4 mils.
- B. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.
  1. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. C274: Applied at a dry film thickness of not less than 1.3 mils.
  2. Sherwin-Williams; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series: Applied at a dry film thickness of not less than 1.6 mils.
- C. Interior Semi-gloss Acrylic Enamel: Factory-formulated Semi-gloss acrylic-latex enamel for interior application.
  1. Benjamin Moore; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276: Applied at a dry film thickness of not less than 1.2 mils.
  2. Sherwin-Williams; ProMar 200 Interior Latex Semi-Gloss Enamel B31W200 Series: Applied at a dry film thickness of not less than 1.3 mils.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
  - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  - 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

### 3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface- applied protection before surface preparation and painting.
  - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
  - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
  - 1. Provide barrier coats over incompatible primers or remove and reprime.
  - 2. Plaster Surfaces: Fill hairline cracks, small holes, and other imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

3. Gypsum Board Surfaces: Fill minor defects with filler compound. Make smooth and flush with adjacent surfaces. Spot prime defects after repair.
4. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
  - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
  - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
  - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry and vacuum before painting.
5. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
  - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
  - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
  - c. If transparent finish is required, backprime with spar varnish.
  - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
  - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
6. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
  - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
  - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
  - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

7. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### 3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
  2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  3. Provide finish coats that are compatible with primers used.
  4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
  5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
  7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
  9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
  10. Sand lightly between each succeeding enamel or varnish coat.

- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
  - 1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
  - 2. Omit primer over metal surfaces that have been shop primed and touchup painted.
  - 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  - 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
  - 1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
  - 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
  - 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
  - 1. Uninsulated metal piping.
  - 2. Uninsulated plastic piping.
  - 3. Uninsulated ductwork.
  - 4. Pipe hangers and supports.
  - 5. Tanks that do not have factory-applied final finishes.

6. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
  7. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
  8. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
- G. Electrical items to be painted include, but are not limited to, the following:
1. Exposed conduits and junction boxes.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats.
- L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.
- 3.4 FIELD QUALITY CONTROL
- A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

### 3.5 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
  1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

### 3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing, or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
  1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### 3.7 EXTERIOR PAINT SCHEDULE

- A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
  1. Semi-gloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.
    - a. Primer: Exterior ferrous-metal primer.
    - b. Finish Coats: Exterior semi-gloss acrylic enamel.
- B. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces:

1. Semi-gloss Acrylic-Enamel Finish: Two finish coats over a galvanized metal primer.
  - a. Primer: Exterior galvanized metal primer.
  - b. Finish Coats: Exterior semi-gloss acrylic enamel.
- C. Exterior Gypsum Soffit Board: Provide the following finish system over exterior gypsum soffit board:
  1. Low-Luster Acrylic Finish: Two finish coats over a primer.
    - a. Primer: Exterior gypsum soffit board primer.
    - b. Finish Coats: Exterior low-luster acrylic paint.

### 3.8 INTERIOR PAINT SCHEDULE

- A. Concrete and Masonry (Other Than Concrete Unit Masonry): Provide the following paint systems over interior concrete and brick masonry substrates:
  1. Semi-gloss Acrylic-Enamel Finish: Two (2) finish coats over a primer.
    - a. Primer: Interior concrete and masonry primer.
    - b. Finish Coats: Interior semi-gloss acrylic enamel.
- B. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:
  1. Low-Luster Acrylic-Enamel Finish: Two (2) finish coats over a block filler.
    - a. Block Filler: Concrete unit masonry block filler.
    - b. Finish Coats: Interior low-luster acrylic enamel.
  2. Semi-gloss Acrylic-Enamel Finish: Two (2) finish coats over a block filler.
    - a. Block Filler: Concrete unit masonry block filler.
    - b. Finish Coats: Interior semi-gloss acrylic enamel.
- C. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
  1. Flat Acrylic Finish: Two (2) finish coats over a primer.
    - a. Primer: Interior gypsum board primer.
    - b. Finish Coats: Interior flat acrylic paint.
  2. Low-Luster Acrylic-Enamel Finish: Two (2) finish coats over a primer.
    - a. Primer: Interior gypsum board primer.
    - b. Finish Coats: Interior low-luster acrylic enamel.
  3. Semi-gloss Acrylic-Enamel Finish: Two finish coats over a primer.
    - a. Primer: Interior gypsum board primer.
    - b. Finish Coats: Interior semi-gloss acrylic enamel.
- D. Plaster: Provide the following finish systems over new interior plaster surfaces:



1. Low-Luster Acrylic-Enamel Finish: Two (2) finish coats over a primer.
    - a. Primer: Interior plaster primer.
    - b. Finish Coats: Interior low-luster acrylic enamel.
  2. Semi-gloss Acrylic-Enamel Finish: Two (2) finish coats over a primer.
    - a. Primer: Interior plaster primer.
    - b. Finish Coats: Interior semi-gloss acrylic enamel.
- E. Wood and Hardboard: Provide the following paint finish systems over new interior wood surfaces:
1. Semi-gloss Acrylic-Enamel Finish: Two (2) finish coats over a wood undercoater.
    - a. Primer: Interior wood primer for acrylic-enamel and semi-gloss alkyd-enamel finishes.
    - b. Finish Coats: Interior semi-gloss acrylic enamel.
- F. Ferrous Metal: Provide the following finish systems over ferrous metal:
1. Semi-gloss Acrylic-Enamel Finish: Two (2) finish coats over a primer.
    - a. Primer: Interior ferrous-metal primer.
    - b. Finish Coats: Interior semi-gloss acrylic enamel.
- G. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:
1. Semi-gloss Acrylic-Enamel Finish: Two (2) finish coats over a primer.
    - a. Primer: Interior zinc-coated metal primer.
    - b. Finish Coats: Interior semi-gloss acrylic enamel.

END OF SECTION 099100

## SECTION 220500 – GENERAL PLUMBING REQUIREMENTS

### 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 and all Division 22 Sections.

#### 1.2 PLANS AND SPECIFICATIONS

- A. All work under this title, on drawings or specified, is subject to the general and special contract conditions for the entire project, and the contractor for this portion of the work is required to refer especially thereto, and to the architectural drawings.
- B. Drawings are diagrammatic and specifications are complementary and must be so interpreted to determine the full scope of work under this heading. Wherever any material, article, operation or method is either specified or shown on the drawings, this contractor is required to provide each item and perform each prescribed operation according to the designate quality, qualification or condition, furnishing all necessary labor, equipment or incidentals.
- C. Wherever the designation "Architect" appears, it shall imply Architect or Engineer. Wherever the term "Contractor" or "PC" appears, it shall imply the Contractor responsible for Division 22, Plumbing Work.

#### 1.3 CONFLICTS

- A. If, in the interpretation of contract documents, it appears that the drawings and specifications are not in agreement, the Contractor is to contact the Engineer. The Engineer shall be the final authority. Addenda supersede the provisions which they amend.
- B. In the absence of a written clarification by the engineer, the Contractor must install his work in accordance with the more stringent condition. Contractor assumes full responsibility for any and all items furnished and installed without the written approval by the Architect or Engineer.

#### 1.4 DIMENSIONS, LAYOUTS AND OBSTACLES

- A. Verify dimensions and elevations from actual field measurements after building construction has sufficiently progressed.
- B. Assume full and final responsibility for the accuracy of any or all work performed under this Division and make repairs and corrections as required or directed at no extra cost to the Owner.
- C. Layouts of piping and equipment shown on drawings are diagrammatic and shall be construed as such. DO NOT SCALE DRAWINGS. Contractor shall field verify all existing conditions prior to fabrication and installation of material. It is recommended that the contractor verify all existing conditions prior to submitting a proposal. Lack of field verification does not constitute a basis for additional monies during construction. Contractor assumes full responsibility for completeness of installation including coordination of work with other trades.
- D. Make actual installations in accord with said layouts, but with necessary deviations as directed or required by job conditions and field measurements in order to produce a thoroughly integrated and practical installation. . Make deviations only with specific approval of the Engineer/Architect.
- E. Take particular care to coordinate all work under this Division to prevent conflict and remove and relocate work as may be made necessary by such conflict at no extra cost to the Owner.
- F. Unless expressly permitted by the Engineer/Architect or shown otherwise on the Drawings, all piping and similar items shall be installed so that they are concealed except as permitted by the Engineer/Architect in service rooms noted on the Drawings.
- G. Fixtures and equipment may be relocated six (6) feet in any direction from locations indicated on plans, before roughing-in, with no change in contract price.

#### 1.5 REVIEW OF MATERIAL

- A. Items specified have been checked by the Engineer for performance and space limitation.
- B. In order for Engineer to consider "equal", Contactor must certify by letter that he has checked the product for conformance to specifications and space limitations and assumes full responsibility thereafter.

- C. Substitutions are defined as any manufacturer and/or model not indicated in drawings or specifications. Requests for substitutions must be made in writing ten (10) days prior to bid date so that an addendum may reach all contractors.
- D. If substitutions are proposed after the bids are received, the Contractor shall state amount of credit to the Owner for substitution. Substitutions that are considered equal by the Contractor and carried in bid without approval by Engineer shall be the responsibility of the Contractor. The Engineer and/or Owner shall not be made liable or responsible for losses incurred by the Contractor, due to the rejection of said items for installation.
- E. Where equipment requiring different arrangement or connections other than as indicated is acceptable, it shall be the responsibility of this Contractor to furnish revised layouts, and install the equipment to operate properly and in harmony with the intent of the drawings and specifications. All changes in the work required by the different arrangement shall be done at no additional cost to the Owner, including but not limited to structural steel modifications. Control and power wiring modifications required by Contractor, imposed modifications, and the additional cost of these modifications, shall be the responsibility of this Contractor.

#### 1.6 PERMITS, CODES AND ORDINANCES

- A. The Contractor shall arrange and pay for all permits, inspections, etc., as required by local utilities or applicable agencies.
- B. All work and material shall be in complete accordance with the ordinances, regulations, codes, etc., of all political entities exercising jurisdictions.

#### 1.7 COORDINATION WITH OTHER TRADES

- A. Check plumbing work with all other trades.
- B. Anticipate and avoid interferences with other trades.
- C. Take particular care to coordinate all piping, ductwork, plumbing and major electrical components above ceiling, to prevent conflict. Remove and relocate work as may be made necessary by such conflict, at no extra cost to the Owner.
- D. Obtain decision for approval from project Engineer for proposed group installation before proceeding, and for clearance in structure and finish of the building.
- E. Running piping over electrical equipment and in elevator machine rooms is prohibited.

- F. The Contractor shall coordinate with, receive and install, Owner furnished equipment where indicated.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery of Materials: Make provisions for delivery and safe storage of all materials. Check and properly receipt material to be "furnished by others" to contractor and assume full responsibility for all materials while in storage with full visible identification and information.

#### 1.9 PROJECT CONDITIONS

- A. Coordination: Field verify existing conditions that will determine exact locations, distances, levels, dimensions, elevations, etc. Review all drawings of other trades and report any conflicts to the Architect/Engineer which will affect the project cost. Lack of field verification does not constitute a basis for additional monies during construction. Contractor assumes full responsibility for completeness of installation including coordination of work with other trades.

#### 1.10 MISCELLANEOUS SUPPORT

- A. Contractor is responsible for providing all miscellaneous support components necessary for properly supporting equipment including hangers, rods, anchors, steel, etc.  
PRODUCTS (not used)

### PART 2 - EXECUTION

#### 2.1 INSTALLATION

- A. Comply with manufacturer's written installation, operations and maintenance instructions for general installation requirements and procedures.

END OF SECTION 220500

## SECTION 220502 - PLUMBING DEMOLITION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Description of Work: Provide plumbing removal work as indicated and as required for removal and/or abandonment of systems, equipment and fixtures, etc. made obsolete by this Project, and as required for removal and remodeling by other trades.

#### 1.2 EXISTING CONDITIONS

- A. General: In general, existing plumbing systems, equipment and fixtures are not shown on the Drawings unless pertinent to the demolition and/or remodeling work. Existing conditions, where indicated, are based on casual field observations and/or historical plans prepared as part of original building fit-out, and must be verified. Report any discrepancies to the Engineer before disturbing the existing installation.
- B. Examination: Prior to bidding, examine the site to determine all actual observable conditions. No additional compensation will be granted on account of extra work made necessary by the Contractor's failure to investigate such existing conditions.

#### 1.3 COORDINATION

- A. Adjoining Areas: It is expected that the Contractor understands that adjoining areas of the building (or project site) must remain in operation and mechanical systems and services must remain in operation at all times, unless specifically approved otherwise.
- B. Scheduling: Plumbing removal work shall be scheduled in conjunction with the other trades. Contractor cooperation will be expected under all conditions.
- C. Area Limits: Construction traffic and removal of debris will be limited to specific areas and routes. Confirm with the Owner.

#### 1.4 ADJACENT MATERIALS

- A. Protection: During execution of removal work, primary consideration shall be given to protecting from damage, building structure, furnishings, finishes and the like, which are not specifically indicated to be removed.

- B. Repairs: Existing items or surfaces to remain, which are damaged as a result of this work shall be refinished, repaired or replaced to the satisfaction of the Owner, at no cost to the Contract.

## 1.5 TRANSIENT SERVICES

- A. Locate and identify any and all plumbing services passing through the project area which serve areas outside the work limits.
- B. Maintain all plumbing services to areas outside the work limits unless specifically authorized otherwise in writing by the Engineer or Owner's Representative. When transient services must be interrupted, provide temporary services for affected areas outside the work limits.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Patching: Materials used for patching shall be in conformance with the applicable sections of the Project Manual. Where materials are not specifically described, but required for proper completion of the Work, they shall be as selected by the Contractor, subject to approval of the Engineer.

## PART 3 - EXECUTION

### 3.1 INSPECTION/VERIFICATION

- A. Inspection: Before commencing work of this Section, carefully inspect the project site and become familiar with existing systems and conditions.
- B. Items to be Salvaged: Verify with the Engineer and Owner's Representative, all systems, materials and equipment which are to be salvaged, and those which must be removed. The Owner reserves the right to salvage any or all existing plumbing materials and equipment at the project site.

### 3.2 COORDINATION

- A. Coordinate removal work with other trades, where applicable.

### 3.3 DEMOLITION

- A. General: Remove plumbing equipment, piping, fixtures and related materials within the project work limits, as indicated.
- B. Disconnections: Disconnect all plumbing work located in walls, ceilings or floors scheduled for removal. Disconnect plumbing connections equipment being removed by other trades.
- C. Protection: Perform all removal work in such a manner so that damage to adjacent items and surfaces is minimized.
- D. Patching: When plumbing materials are removed, patch and finish surfaces to remain to match surrounding surfaces.

### 3.4 EXISTING PLUMBING WORK TO REMAIN

- A. General: Protect and maintain access to existing plumbing work which must remain. Reinstall existing plumbing work where disturbed.
- B. Reconnections: Where plumbing work in adjoining areas or plumbing work indicated to remain, becomes disconnected or affected by demolition work, reconnect as required, to restore original operation. Restoration work to comply with requirements for new work.

### 3.5 EXISTING PLUMBING WORK TO BE RELOCATED

- A. General: Disconnect, remove, reinstall and reconnect existing equipment indicated to be relocated and where require to accommodate remodeling or new construction. Extend existing installations as required. Materials and methods used for relocations and extensions to conform to requirements for new work.

### 3.6 SHUTDOWNS

- A. General: All shutdowns to existing plumbing services to be scheduled and approved, in writing, by the Owner.

### 3.7 DISPOSITION OF EXISTING MATERIALS AND EQUIPMENT

- A. Items to Salvage: Material and equipment which is indicated (or directed by Owner) to be salvaged, shall be carefully removed and stored where directed on the site.



- B. Items to Reuse/Relocate: Carefully remove and store on site, all material and equipment indicated to be reused or relocated. Thoroughly clean, and make any necessary minor repairs to such equipment, prior to installation.
- C. Items to Remove: Remove and legally dispose of all other materials and debris resulting from demolition work on a daily basis.

### 3.8 CLEANING

- A. Remove from the Project Site all dirt, dust and debris resulting from removal operations daily. Refuse shall not be allowed to block or otherwise impair circulation in corridors, stairs, sidewalks, roadways or other traffic areas.

END OF SECTION 220502

## SECTION 220529 – SUPPORTS AND SLEEVES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Perform all Work required to provide and install supports, hangers, anchors, sleeves and bases for all pipe, duct, equipment, system components and accessories, indicated by the Contract Documents with all supplementary items necessary for complete, code compliant and approved installation

#### 1.2 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and Workmanship shall comply with the applicable requirements and standards addressed within the following references:
  - 1. International Plumbing Code.
  - 2. International Fuel Gas Code.
  - 3. ASME B31.2 – Fuel Gas Piping.
  - 4. ASME B31.9 – Building Services Piping.
  - 5. ASTM F708 – Design and Installation of Rigid Pipe Hangers.
  - 6. MSS SP58 – Pipe Hangers and Supports - Materials, Design and Manufacturer.
  - 7. MSS SP69 – Pipe Hangers and Supports - Selection and Application.
  - 8. MSS SP89 – Pipe Hangers and Supports - Fabrication and Installation Practices.
  - 9. MSS SP-90 – Guidelines on Terminology for Pipe Hangers and Supports.

#### 1.3 QUALITY ASSURANCE

- A. Materials and application of pipe hangers and supports shall be in accordance with MSS-SP-58 and SP-69 unless noted otherwise.
- B. Support and sleeve materials and installation shall not interfere with the proper functioning of equipment.

- C. Contractor shall be responsible for structural integrity of all hangers, supports, anchors, guides, inserts and sleeves. All structural hanging materials shall have a minimum safety factor of five.
- D. Installer Qualifications: Utilize an installer experienced in performing Work of this Section who is experienced in installation of Work similar to that required for this Project and per the minimum requirements of MSS SP-89. Field welding of supports shall be by certified welders qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX using welding procedures per the minimum requirements of MSS SP-58.

#### 1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog data including code compliance, load capacity, and intended application.
- B. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.
- C. Shop Drawings: Submit detailed Drawings of all shop or field fabricated supports, anchors and sleeves, signed and sealed by a qualified State of New York registered professional engineer. Indicate size and characteristics of components and fabrication details and all loads exceeding 750 pounds imposed on the base building structure.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Maintain in place until installation.
- C. Store materials protected from exposure to harmful weather conditions.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

## 2.2 MANUFACTURERS

### A. Hangers and Supports:

1. Anvil International.
2. Kinder.
3. Cooper B-Line.
4. C & S Mfg. Corp.
5. Hubbard Enterprises/Holdrite.
6. National Pipe Hanger Corporation.
7. Power Strut.

## 2.3 HANGERS AND SUPPORTS

### A. General:

1. Refer to individual system and equipment Specification Sections for additional support requirements. Comply with MSS SP-69 for support selections and applications that are not addressed within these Specifications.
2. Utilize hangers and supports to support systems under all conditions of operation, allowing free expansion and contraction, and to prevent excessive stresses from being introduced into the structure, piping or connected equipment.
3. All pipe supports shall be of the type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.
4. Design hangers to impede disengagement by movement of supported pipe.
5. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping.
6. Wire or perforated strap iron will not be acceptable as hanger material.
7. Hanger rods shall be threaded on both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.
8. Fasteners requiring explosive powder (shooting) or pneumatic-driven actuation are not acceptable.
9. Plastic anchors or plastic expansion shields will not be permitted under any circumstances.
10. Hangers and clamps supporting and contacting individual non-insulated brass or copper lines shall be copper or copper plated. Where non-insulated brass or copper lines are supported on trapeze hangers or channels, the pipes shall be isolated from these supports with approved flexible elastomeric/thermoplastic isolation cushion

material to completely encircle the piping and avoid contact with the channel or clamp. Plastic tape is not acceptable.

11. Hangers and clamps supporting and contacting glass piping shall be in accordance with the piping manufacturer's published recommendations and shall be fully lined with minimum 1/4 inch neoprene padding. The padding material and the configuration of its installation shall be submitted for approval.
  12. Hangers and clamps supporting and contacting plastic piping shall be in accordance with the piping manufacturer's published recommendations and shall be factory coated or padded to prevent damage to piping.
  13. Field fabricated supports shall be constructed from ASTM A36/A36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- B. Finishes: All ferrous hangers, rods, inserts, clamps, stanchions, and brackets on piping within interior non-corrosive environments, shall be dipped in Zinc Chromate Primer before installation. Rods may be galvanized or cadmium plated after threading, in lieu of dipping zinc chromate. All hangers and supports exposed to the weather, including roofs and building crawl space areas, shall be galvanized or manufactured from materials that will not rust or corrode due to moisture.
- C. Vertical Piping:
1. Supports for vertical riser piping in concealed areas shall utilize double bolt riser clamps, with each end having equal bearing on the building structure at each floor level.
  2. Supports for vertical riser piping at floor levels in exposed areas shall be attached to the underside of the penetrated structure utilizing drilled anchors, two hanger rods (sized as specified), and socket clamp with washers.
  3. Two-hole rigid pipe clamps or four-hole socket clamps with washers may be used to support pipe directly from adequate structural members where floor-to-floor distance exceeds required vertical support spacing and lines are not subject to expansion and contraction.
- D. Trapezes: Where multiple lines are run horizontally at the same elevation and grade, they may be supported on manufactured channel, suspended on rods or pipes. Trapeze members including suspension rods shall be properly sized for the quantity, diameters, and loaded weight of the lines they are to support.
- E. Fixture and Equipment Service Piping:
1. Piping at local connections to plumbing fixtures and equipment shall be supported to prevent the weight of the piping from being transmitted to fixtures and equipment.
  2. Makeshift, field-devised methods of plumbing pipe support, such as with the use of scrap framing materials, are not allowed. Support and positioning of piping shall be

by means of engineered methods that comply with IAPMO PS 42-96. These shall be Hubbard Enterprises/Holdrite support systems, C & S Mfg. Corp. or approved equivalent.

3. Supports within chases and partitions shall be corrosion resistant metal plate, clamps, angles or channels, and aligned with structure in the vertical or horizontal position. Plastic supports are not allowed without written approval.
4. Horizontal supports within chases and partitions that are attached to studs shall be attached at both ends. Drywall shall not be relied upon to support the piping.
5. Supports for plumbing fixture water service piping within chases and partitions may be attached to cast iron drain and vent pipe with approved brackets and pipe clamps.
6. Piping exposed on the face of drywall shall be supported with corrosion resistant metal channels that are attached to wall studs. Drywall shall not be relied upon to support the piping.
7. Piping supported from the floor shall utilize corrosion resistant metal channels or brackets that are anchored to the floor slab.
8. All water piping shall be isolated from building components to prevent the transmission of sound.
9. All copper or brass lines shall be isolated from ferrous metals with dielectric materials to prevent electrolytic action. Plastic tape is not an acceptable isolation material.

F. Inserts:

1. Cast-in-place concrete inserts shall comply with MSS-SP-69, U.L. and F.M. approved, and sized to suit threaded hanger rods.
2. Inserts shall have malleable iron case with galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction. If the inserts are later found not to be in the proper location for the placement of hangers, then drilled anchors shall be installed. Drilled anchors in concrete or masonry shall be submitted for the approval.
3. Manufactured inserts for metal deck construction shall have legs custom fit to rest in form valleys.
4. Shop fabricated inserts shall be submitted and approved by Owner prior to installation.
5. Inserts shall be of a type that will not interfere with structural reinforcing and that will not displace excessive amounts of structural concrete.

- G. Pipe Shields: Provide pipe shields in accordance with insulation manufacturer's published recommendations. Install MSS SP-58, Type 39 protection saddles, if insulation

without vapor barrier is indicated. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier.

H. Housekeeping Pads:

1. Provide minimum 4 inch reinforced concrete pads with chamfered corners and equipment bases for all outdoor equipment on grade, floor mounted equipment in main central plant area, mechanical rooms, areas with floors below grade, penthouse equipment rooms, floor mounted air handling units, and where shown on Drawings.
2. Housekeeping pads shall extend minimum of 4 inch on all sides beyond the limits of the mounted equipment unless otherwise noted.
3. Provide galvanized anchor bolts for all equipment placed on concrete pads or on concrete slabs of the size and number recommended by the equipment manufacturer.

## 2.4 THROUGH PENETRATIONS

A. General:

1. Seal penetrations through all rated partitions, walls and floors with U.L. tested assemblies to provide and maintain a rating equal to or greater than the partition, wall or floor.
2. Inside diameter of all sleeves or cored holes shall provide sufficient annular space between outside diameter of pipe or insulation to allow proper installation of required fire and water proofing materials and allow for movement due to expansion and contraction.
3. Exposed ceiling, floor and wall pipe penetrations within finished areas (including exterior wall faces) shall be provided with chrome plated, brass or stamped steel, hinged, split-ring escutcheon with set screw or snap-on type. Inside diameter shall closely fit pipe outside diameter or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings. In exterior, damp, or corrosive environments, use Type 302 stainless steel escutcheons.

B. Floor Pipe Penetrations:

1. Seal penetrations through all floors to provide and maintain a watertight installation.
2. Sleeves cast in the slab for pipe penetrations shall be Schedule 40 steel, ASTM A53, with 2 inch wide annular fin water-stop continuously welded at midpoint. Entire assembly shall be hot-dipped galvanized after fabrication. Water-stop shall be same thickness as sleeve.

3. Cored holes in the slab for pipe penetrations shall be provided with a Schedule 40 steel, ASTM A53, sleeve with 2 inch wide annular fin water-stop continuously welded at point on sleeve to allow countersinking into slab and waterproofing. Entire sleeve assembly shall be hot-dipped galvanized after fabrication. Water-stop shall be same thickness as sleeve.
  4. All sleeves shall extend a minimum of two inches above finished floor.
  5. Where job conditions prevent the use of a sleeve that extends two inches above the slab, Link-Seal mechanical casing seals manufactured by Thunderline Corporation may be installed to provide a watertight penetration. Mechanical casing seals can be used only for relatively small diameter pipe penetrations. Verify that slab thickness allows proper installation of the link-seal assembly and the required fire stopping prior to applying this exception.
- C. Wall Penetrations:
1. Where piping passes through non-rated partition, close off space between pipe and construction with gypsum wallboard and repair plaster smoothed and finished to match adjacent wall area.
  2. Pipe penetrations through interior rated partitions shall be provided with adjustable prefabricated U.L. listed fire rated galvanized sheet metal sleeves having gauge thickness as required by wall fire rating, 20 gauge minimum. EXCEPTION: When U.L. Listed assembly does not require a sleeve,
  3. Pipe penetrations through exterior walls and walls below grade shall be provided with "Link-Seal" mechanical casing seal manufactured by Thunderline Corporation.
- D. Flashing:
1. Coordinate flashing material and installation required for pipe roof penetrations with Owner and roofing Contractor.
  2. Provide acoustical flashing around pipes penetrating equipment rooms, with materials and installation in accordance with manufacturer's instructions for sound control.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Conduct a pre-installation meeting prior to commencing Work of this Section to verify Project requirements, coordinate with other trades, establish condition and completeness of substrate, review manufacturer's installation instructions and manufacturer's warranty requirements.



### 3.2 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. Application, sizing and installation of piping, supports, anchors and sleeves shall be in accordance with manufacturer's printed installation instructions.
- C. Provide for vertical adjustments after erection and during commissioning, where feasible, to ensure pipe is at design elevation and slope.
- D. Install hangers and supports to allow controlled thermal movement of piping systems, permitting freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- E. Install hanger so that rod is vertical under operating conditions.
- F. Supports, hangers, anchors, and guides shall be fastened to the structure only at such points where the structure is capable of restraining the forces in the piping system.
- G. The load and spacing on each hanger and/or insert shall not exceed the safe allowable load for any component of the support system, including the concrete that holds the inserts. Reinforcement at inserts shall be provided as required to develop the strength required. Contractor shall be responsible for engaging a structural engineer as required for design and review at support systems.
- H. Do not hang pipe or any item directly from a metal deck or locate on the bottom chord of any truss or joist unless approved by the Structural Engineer of Record.
- I. All supports shall be designed and installed to avoid interference with other piping, hangers, ducts, electrical conduit, supports, building structures, equipment, etc.
- J. Piping supports shall be independent from other supports. Combining supports is not permitted.
- K. Provide all supporting steel required for the installation of plumbing equipment and materials, including angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may not be specifically indicated on the Drawings.
- L. Piping supports shall be designed and installed to allow the insulation to be continuous through the hangers.
- M. Adjustable clevis hangers shall be supported at rods with a nut above and below the hanger.

- N. All hanger rods shall be trimmed neatly so that 1 inch of excess hanger rod protrudes beyond the hanger nut. In the event a rod is intentionally but temporarily left excessively long (for sloped or insulated lines for example), the Contractor shall take appropriate measures to protect the pipe or other materials from damage.
- O. Install hangers to provide minimum ½ inch space between finished covering and adjacent structures, materials, etc.
- P. Horizontal and vertical piping in chases and partitions shall be supported to prevent movement and isolated from the supports to prevent transmission of sound.
- Q. Locate hangers within 12 inches of each horizontal elbow.
- R. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- S. Support riser piping independently of connected horizontal piping. Riser piping is defined as vertical piping extending through more than one floor level.
- T. Support riser piping at each floor level and provide additional supports where floor-to-floor distance exceeds required vertical support spacing. Installation of riser clamps and welded steel riser supports shall not allow weight of piping to be transmitted to floor sleeves.
- U. Steel Bar Joists: Hanger rods shall be secured to angle irons of adequate size; each angle shall span across two or more joists as required to distribute the weight properly and shall be welded or otherwise permanently fixed to the top of joists.
- V. Steel Beams: Where pipes and loads are supported under steel beams, approved type beam clamps shall be used.
- W. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- X. Flashing:
  - 1. Coordinate all roof flashing with requirements of Division 07.
- Y. Pipe Shields:
  - 1. Provide shields at each hanger supporting insulated pipe.
  - 2. Provide shields of the proper length to distribute weight evenly and to prevent compression of insulation at hanger.

3. Install shield so that hanger is located at the center of the shield.
4. Attach shield to insulation with adhesive to prevent slippage or movement.

Z. Equipment Anchor Bolts:

1. Foundation bolts shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Each bolt shall be set in a sleeve of sufficient size to provide ½ inch clearance around bolt.

END OF SECTION 220529

## SECTION 220553 – PLUMBING IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve tags.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.3 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White
3. Background Color: Black
4. Maximum Temperature: Able to withstand temperatures up to 180 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger

lettering for greater viewing distances. Include secondary lettering two-thirds to three-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. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White
- C. Background Color: Red
- D. Maximum Temperature: Able to withstand temperatures up to 180 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

## 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

## 2.4 VALVE TAGS

- A. Valve Tags: 1-1/2 inch diameter, stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 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.

### 3.3 VALVE TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

END OF SECTION 220553

## SECTION 221000 – PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Provide materials and installation for complete plumbing systems, within and to five feet beyond building perimeter unless noted otherwise on Contract Drawings; Sanitary Waste and Vent Piping, Storm Drain Piping, Domestic Water Piping, Domestic Water Valves, Testing and other normal parts that make the systems operable, code compliant and acceptable to the authorities having jurisdiction.

#### 1.2 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
  - 1. New York State Plumbing Code.
  - 2. ANSI/NSF Standard 61 - Drinking Water System Components - Health Effects.
  - 3. ANSI/NSF Standard 372 – Lead Content in domestic water systems

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer's name and pressure rating shall be permanently marked on valve body.
- B. The Contractor shall notify the manufacturer's representative prior to installing any copper press fittings. The Contractor shall obtain the representative's guidance in any unfamiliar installation procedures. The manufacturer's representative of copper press fittings shall conduct periodic inspections of the installation and shall report in writing to the Contractor and Owner of any observed deviations from manufacturer's recommended installation practices.
- C. Manufacturer Qualifications: Company shall have minimum three years documented experience specializing in manufacturing the products specified in this section.
- D. Installer Qualifications:



1. Company shall have minimum three years documented experience specializing in performing the work of this section.
  2. All installers of copper press fittings shall be trained by the fitting manufacturer's appointed representative. Written notification of training shall be submitted to Owner prior to any installation.
- E. Special Engineered products shall be certified by NSF International as complying with NSF 14.

#### 1.4 SUBMITTALS

A. Product Data:

1. Code and Standards compliance, manufacturer's data for pipe, fittings, valves and all other products included within this specification section.
2. Manufacturer's installation instructions.

B. Record Documents:

1. Record actual locations of valves, etc. and prepare valve charts.
2. Test reports and inspection certification for all systems listed herein.
3. Provide a certificate of completion detailing the domestic water system chlorination procedure.
4. Submit proposed location of access panels which vary from quantities or locations indicated on Contract Drawings.

C. Operation and Maintenance Data:

1. Include components of system, servicing requirements, Record Drawings, inspection data, installation instructions, exploded assembly views, replacement part numbers and availability, location and contact numbers for service.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. All materials shall be new, undamaged, and free of rust.
- B. Accept valves on Site in shipping containers and maintain in place until installation.
- C. Provide temporary protective coating and end plugs on valves not packaged within containers. Maintain in place until installation.
- D. Provide temporary end caps and closures on pipe and fittings. Maintain in place until installation.

- E. Protect installed piping, valves and associated materials during progression of the construction period to avoid clogging with dirt, and debris and to prevent damage, rust, etc. Remove dirt and debris and repair materials as work progresses and isolate parts of completed system from uncompleted parts.
- F. Protect all materials that are to be installed within this project from exposure to rain, freezing temperatures and direct sunlight. EXCEPTION: Materials manufactured for exterior locations.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Provide materials as specified herein and indicated on Contract Drawings. All materials and work shall meet or exceed all applicable Federal and State requirements and conform to adopted codes and ordinances of authorities having jurisdiction.
- C. Pressure ratings of pipe, fittings, couplings, valves, and all other appurtenances shall be suitable for the anticipated system pressures in which they are installed.
- D. All materials within domestic water distribution systems that may come in contact with potable water delivered shall comply with ANSI/NSF standard 61.

### 2.2 SANITARY WASTE AND VENT AND STORM DRAINAGE PIPING

#### A. BELOW GRADE SANITARY WASTE AND VENT PIPING

- 1. Hub-and-Spigot, Cast-Iron Soil Pipe and Fittings.
  - a. Pipe and Fittings: ASTM A 74, Service Weight.
  - b. Gaskets: ASTM C 564, rubber.

#### B. ABOVE GRADE SANITARY WASTE AND VENT PIPING

- 1. Hubless, Cast-Iron Soil Pipe and Fittings.
  - a. Pipe and Fittings: ASTM A 888 or CISPI 301.
  - b. CISPI, Hubless-Piping Couplings:

- c. Standards: ASTM C 1277 and CISPI 310.
- d. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Pipe and fittings shall be manufactured as a system and be the product of one manufacturer.
- D. All pipe and fittings shall be manufactured in the United States. All systems shall utilize a separate waste and vent system. Pipe and fittings shall conform to National Sanitation Foundation Standard 14.
- E. All P-traps for floor drains, floor sinks and hub drains shall be deep-seal type.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Before commencing work, check final grade and pipe invert elevations required for drain terminations and connections to ensure proper slope.

#### 3.2 PREPARATION

- A. Ream pipes and tubes. Remove burrs, scale and dirt, inside and outside, before assembly. Remove foreign material from piping.
- B. Prepare piping connections to equipment with flanges or unions.

#### 3.3 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.
- C. General
  - 1. Care shall be exercised to avoid all cross connections and to construct the plumbing systems in a manner which eliminates the possibility of water contamination.

2. Install all materials and products in accordance with manufacturer's published recommendations. Use tools manufactured for the installation of the specific material or product.
3. Wipe all paste residue and excess solder from all solder joints.
4. Heat generated by soldering procedures shall not be transmitted to valves, copper alloy roll groove fittings, copper press fittings, no-hub clamps, or any other components installed within the piping system that may be damaged due to high temperatures. Contractor shall take all precautions necessary, including utilizing wet wrapping or allowing heated piping to cool to ambient temperature before attachment.
5. Pipe joints, flanges, unions, etc., shall not directly contact or be encased in concrete, or be located within wall, floor or roof penetrations.
6. Grooved Joints: Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. The gasket style and elastomeric material shall be verified as suitable for the intended service as specified. Flexible couplings only to be used for expansion loops, pump trim and where approved by the engineer. A factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. All groove depths shall be checked manually or by grooving tool (RG5200i). A Victaulic representative shall periodically visit the job site and review installation.
7. Route piping in direct orderly manner and maintain proper grades. Installation shall conserve headroom and interfere as little as possible with use of spaces. Route exposed piping parallel to walls. Group piping whenever practical at common elevations.
8. Install piping to allow for expansion and Contraction without stressing pipe, joints or connected equipment.
9. Furnish all supports required by the piping included in this specification section.
10. Penetrations through fire rated walls, floors and partitions shall be sealed to provide a U.L. rating equal to or greater than the wall, floor or partition.
11. Seal all penetrations through floors, air and water tight.
12. Each plumbing pipe projecting through roof shall be installed in accordance with Contract Specifications and Drawings. Penetrations shall be sealed air and water tight. Refer to details on Contract Drawings and coordinate with General Contractor for flashing requirements.
13. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. for each piece of equipment (including Owner furnished equipment) having plumbing connections, to facilitate proper functioning, servicing and compliance with code.
14. Provide code-approved transition adapters when joining dissimilar piping materials. Adaptors installed shall be manufactured specifically for the particular transition.
15. All piping shall have reducing fittings used for reducing or increasing where any change in the pipe sizes occurs. No bushing of any nature shall be allowed in piping.

16. Close nipples shall not be installed in plumbing piping systems.
17. Buried piping shall be supported throughout its entire length.
18. All excavation required for plumbing work is the responsibility of the plumbing Contractor and shall be done in accordance with Contract Documents.
19. Piping shall be insulated in accordance with Contract Documents.
20. Provide clearance for installation of insulation and for access to valves, air vents, drains, unions, etc.
21. Provide dielectric isolation device where non-ferrous components connect to ferrous components. Devices shall be dielectric union, coupling or dielectric flange fitting.
22. All piping shall be isolated from building structures, including partition studs, to prevent transmission of vibration and noise.
23. Isolate all bare copper pipe from ferrous building materials. Tape is not an acceptable isolator.

D. Drainage and Vent Systems

1. Installation shall comply with the latest installation instructions published by the manufacturer and shall conform to all local plumbing, building, and fire code requirements.
2. Systems shall be hydrostatically tested after installation.
3. Slope drainage lines uniformly at 1/4" per foot, for lines 3" and less, and 1/8" per foot for larger lines, unless noted otherwise on Contract Drawings. Maintain gradients through each joint of pipe and throughout system.
4. Buried pipe shall be laid on a smoothly graded, prepared subgrade soil foundation true to alignment and uniformly graded. Bell holes shall be hand-excavated so that the bottom of the pipe is in continuous contact with the surface of the prepared subgrade material. Piping invert shall form a true and straight line.
5. The size of drainage piping shall not be reduced in size in the direction of flow. Drainage and vent piping shall conform to the sizes indicated on the Contract Drawings. Waste lines from water closets shall not be smaller than four inches. Under no circumstances shall any drain or vent line below slab be smaller than two inches.
6. Unburied horizontal drain piping shall be supported at least at every other joint except that when the developed length between supports exceeds four feet, they shall be provided at each joint. Supports shall also be provided at each horizontal branch connection and at the base of each vertical rise. Supports shall be placed immediately adjacent to the joint. Suspended lines shall be braced to prevent horizontal movement. Unburied vertical drain piping rising through more than one floor level shall be supported with riser clamps at each floor level.
7. All unburied change of direction fittings within the storm drainage system shall be braced against thrust loads that might result in joint separation due to dynamic

- forces caused by sudden, heavy rainfall conditions. Bracing shall incorporate galvanized steel pipe clamps and tie rods.
8. Provide cleanouts within sanitary waste systems at locations and with clearances as required by the code, at the base of each waste stack and at intervals not exceeding 75 feet in horizontal runs.
  9. Provide cleanouts at the base of each vertical downspout and at intervals not exceeding 75 feet in horizontal building storm drain. Provide clearances as required by code.
  10. A removable sink or lavatory p-trap with cleanout plug shall be considered as an approved cleanout for 2" diameter pipe.
  11. All interior cleanouts shall be accessible from walls or floors. Provide wall cleanouts in lieu of floor cleanouts wherever possible. A floor cleanout shall be installed only where installation of a wall cleanout is not practical.
  12. Provide a wall cleanout for each water closet or battery of water closets. Locate wall cleanouts above the flood level rim of the highest water closet but no more than twenty-four inches above the finished floor.
  13. Coordinate the location of all cleanouts with the architectural features of the building and obtain approval of locations from the Project Architect.
  14. Lubricate cleanout plugs with anti-seize lubricant before installation. Prior to final completion, remove cleanout plugs, re-lubricate and reinstall using only enough force to provide a water and gas tight seal.
  15. Install trap primer supply to floor drains, hub drains and floor sinks that are susceptible to trap seal evaporation and where indicated on Project Drawings. Primer unit installation shall comply with manufacturer's published recommendations. Trap primer lines shall slope to drain at a minimum 1/4" per foot.
  16. Capped waste and vent connections for future extensions shall be located accessibly and not extend more than 24" from active main. Waste connections and vent connections shall be located at elevations that will allow future installation of properly sloped piping without the need to dismantle or relocate installed ductwork, piping, conduit, light fixtures, etc.
  17. Locate all sanitary vent terminals a minimum of 25 feet horizontally from or 3 feet vertically above all air intakes, operable windows, doors and any other building openings.
  18. Wastewater when discharged into the building drainage system shall be at a temperature not higher than 140°F. When higher temperatures exist, approved cooling methods shall be provided.
  19. Provide spring loaded type check valves on discharge of water pumps.
  20. Provide accessible check valves in the individual cold and hot water fixture supply lines serving mixing valve type faucets or assemblies having hose connection outlets that are not equipped with integral check stops.
  21. Install a shutoff valve immediately upstream of each strainer.
  22. Install domestic hot water return circuit balancing valves where indicated on Contract Drawings and locate a minimum of five pipe diameters downstream and

three pipe diameters upstream of all fittings and/or line shut-off valves. Location of valves shall allow unobstructed access for monitoring and adjustment.

23. Adjust and set domestic hot water return circuit balancing valves to flows indicated on Contract Drawings and in accordance with valve manufacturer's published instructions. Use flow meter recommended by valve manufacturer.
24. Provide a temperature gauge, strainer, union and line shut-off valve upstream of each hot water return circuit balancing valve.

### 3.4 TESTING AND CLEANING

#### A. General

1. Equipment, material, power, and labor necessary for the cleaning, flushing, sterilization, inspection and testing of systems covered within this Specification Section shall be furnished by the Plumbing Contractor.
2. All new and parts of existing altered, extended, or repaired plumbing system piping shall be tested and inspected for leaks and defects. Piping being tested shall not leak nor show any loss in test pressure for duration specified.
3. In cases of minor installation and repairs where specified water and/or air test procedures are deemed impractical, Contractor shall obtain written approval from Owner's Representative to perform alternate testing and inspection procedures. Alternate testing and inspection procedures for minor installation and repairs shall include visual evaluation of installed components by Owner's Representative during a simulation of use.
4. The water utilized for tests shall be obtained from a potable source of supply.
5. Prepare testing reports. If testing is performed in segments, submit separate report for each segment, complete with diagram or clear description of applicable portion of piping. After inspection has been approved or portions thereof, certify in writing the time, date, name and title of the persons reviewing the test. This shall also include the description of what portion of the system has been approved. Obtain approval signature by Owner's Representative. A complete record shall be maintained of all testing that has been approved and shall be made available at the job Site. Upon completion of the work, all records and certifications approving testing requirements shall be submitted to the Owner's Representative before final payment is made.
6. Verify systems are complete, flushed and clean prior to testing. Isolate all equipment subject to damage from test pressure. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. Leave piping uninsulated, uncovered and unconcealed until it has been tested and approved. Where any portion of piping system must be concealed before completion of entire system, the portion shall be tested separately as specified for the entire system prior to concealment. Contractor shall expose all untested covered or concealed piping.

7. Gauges used for testing shall have increments as follows:
  - a. Tests requiring a pressure of 10 psi or less shall utilize a testing gauge having increments of 0.10 psi or less.
  - b. Tests requiring a pressure of greater than 10 psi but less than or equal to 100 psi shall utilize a testing gauge having increments of 1 psi or less.
  - c. Tests requiring a pressure of greater than 100 psi shall utilize a testing gauge having increments of 2 psi or less.
8. Separately test above and below ground piping.
9. Do not introduce test water into piping systems when exposure to freezing temperatures is possible.
10. Do not introduce test water into sections of piping located above existing sensitive areas and/or equipment that may be damaged or contaminated by water leakage. Coordinate with Owner's Representative to determine areas and/or equipment considered as being sensitive.
11. Defective work or material shall be reworked and replaced, and inspection and test repeated. Repairs shall be made with new materials. Pipe dope, caulking, tape, dresser couplings, etc., shall not be used to correct deficiencies.
12. The Contractor shall be responsible for cleaning up any leakage during flushing, testing, repairing and disinfecting to the original condition any building parts subjected to spills or leakage.

B. Drainage and Vent System

1. Subject gravity drainage and vent piping and joints to a vertical water column pressure of at least ten feet. If after 15 minutes the level of the water has been lowered by leakage, the leaks must be found and stopped and the water level shall again be raised to the level described and the test repeated until, after a 15 minute retention period, there shall be no perceptible lowering of the water level in the system being tested. EXCEPTION: Portions of drainage and vent piping located on uppermost level of building shall be subjected to a water column pressure created by filling the system to point of overflow at roof vent terminals and roof drains. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 15 minutes.
2. Should the completion of these tests leave any reasonable question of a doubt relative to the integrity of the installation, additional tests or measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's Representative.
3. Test plugs must extend outside the end of pipe to provide a visible indication for removal after the test has been completed.

END OF SECTION 221000



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## SECTION 221030 – PLUMBING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Provide all materials and installation for plumbing specialties and other normal components that make the systems complete, operable, code compliant and acceptable to the authorities having jurisdiction.
- B. Within building domestic water, sanitary waste and storm drainage systems; floor drains and cleanouts.
- C. This Section includes the following plumbing specialties:
  - 1. Floor Drains.
  - 2. Cleanouts.

#### 1.2 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
  - 1. New York State Plumbing Code.
  - 2. ANSI/NSF Standard 61 - Drinking Water System Components - Health Effects.
  - 3. ANSI/NSF Standard 372 – Lead Content in domestic water systems
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. UL Compliance: UL 778 for motor-operated water pumps.

#### 1.3 QUALITY ASSURANCE

- A. All materials shall be new, undamaged, and free of rust. Protect installed products and associated materials during progression of the construction period to avoid clogging

with dirt, and debris and to prevent damage, rust, etc. Remove dirt and debris as work progresses.

- B. Manufacturer Qualifications: Company shall have minimum three years documented experience specializing in manufacturing the products specified in this section.
- C. NSF Compliance:
  - 1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

#### 1.4 SUBMITTALS

- A. Product Data:
  - 1. Provide Code and Standards compliance, component dimensions, service sizes and finishes.
- B. Record Documents:
  - 1. Manufacturer's certification documentation for backflow preventers.
  - 2. Submit proposed location of access panels which vary from quantities or locations indicated on Contract Drawings.
  - 3. Provide full written description of manufacturer's warranty.
  - 4. Record actual locations of plumbing specialties installed.
- C. Operation and Maintenance Data:
  - 1. Include testing procedures for backflow preventers, adjustment procedures for water pressure regulating valves.
  - 2. Include installation instructions, exploded assembly views, servicing requirements, inspection data, installation instructions, spare parts lists, replacement part numbers and availability, location and contact numbers for service, for all plumbing specialties installed.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Accept specialties on site in shipping containers and maintain in place until installation.
- B. Provide temporary protective coating and end plugs on valves not packaged within containers. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of completed system.

- D. Protect all materials before and after installation from exposure to rain, freezing temperatures and direct sunlight. EXCEPTION: Materials manufactured for installation within exterior environments.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Provide plumbing specialties as indicated and scheduled on the Contract Drawings and as specified herein. All materials and work shall meet or exceed all applicable Federal and State requirements and conform to adopted codes and ordinances of authorities having jurisdiction.
- C. Pressure and temperature ratings of plumbing specialties shall be suitable for the anticipated system pressures and temperatures in which they are installed.
- D. All materials within domestic water distribution systems that may come in contact with the potable water delivered shall comply with ANSI/NSF Standard 61.
- E. All brass and bronze plumbing specialties within domestic water distribution systems that may come in contact with the potable water delivered shall certified lead free and have no more than 15% zinc content.
- F. Specialties of same type shall be product of one manufacturer.

### 2.2 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following for each type:
  - 1. Floor Drains: Wade, Zurn, Smith, Josam.
  - 2. Wall/Floor Cleanouts: Wade, Zurn, Smith, Josam.

### 2.3 FLOOR DRAINS (FD)

- A. Standard: ASME A112.6.3

- B. All floor drains shall be furnished and installed with all options and accessories required for a waterproof installation within the particular construction in which they are to be mounted.
- C. Each floor drain shall be provided with a deep-seal p-trap and trap guard unless noted otherwise.
- D. Floor drains installed for general floor area drainage within toilet rooms and other finished spaces shall have cast iron body with flange, adjustable top and sediment bucket, integral reversible clamping collar, seepage openings, 1/2" plugged primer tap, and 6" diameter stainless steel strainer with vandal proof screws.
- E. Floor drains installed for general floor area drainage and light to medium flow indirect equipment discharge within mechanical rooms shall have cast iron body with plugged 1/2" primer tap, integral clamping collar, seepage openings, adjustable 6" round top, 4" pipe connection and 11-1/2" diameter ductile iron loose set tractor grate.
- F. All floor drains shall be as sized on Contract Drawings.

#### 2.4 CLEANOUTS:

- A. Cleanouts shall be the same nominal size as the pipe they serve up to four inches. For pipes larger than four inches nominal size, the size of cleanouts shall be six inches.
- B. Cleanouts shall have tapered cast brass or bronze plug providing gas and watertight seal.
- C. Interior floor cleanouts shall have scoriated, adjustable top. Provide carpet marker when installed in areas to be covered by carpet.
- D. Exterior cleanouts at grade shall have scoriated cast iron top.
- E. Wall cleanouts shall be provided with stainless steel access covers of adequate size to allow rodding of drainage system. Wall cleanouts incorporating cover screws that extend completely through the access plug are not acceptable.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Coordinate cutting and forming of roof and floor construction to receive drains with General Contractor.

- B. Verify location of equipment and housekeeping pads prior to installation of floor drains. Relocation due to misplacement shall be at Contractor's expense.

### 3.2 INSTALLATION

#### A. General

1. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
2. Install plumbing specialties in accordance with manufacturer's published instructions.

#### B. Drains and Cleanouts

1. Extreme care shall be used to set the top elevation of floor drains and floor sinks to meet the low point elevation of the finished floor.
2. Pipe connections to roof drains, above grade floor drains and floor sinks shall not directly contact or be encased in concrete.
3. Final mounting of interior cleanout top or access cover shall be set flush with the finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil.
4. Encase exterior cleanouts within 14" x 14" x 6" thick reinforced concrete pad. Set top flush with finished grade surface.
5. Locate cleanouts with required clearance for rodding of drainage system.

END OF SECTION 221030

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## SECTION 221429 - SUMP PUMPS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Submersible high temperature sump pump

B. Related Sections include the following:

1. Division 7 Section "Firestopping" for fire resistive penetrations.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, construction materials, and furnished specialties and accessories.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: UL/CSA listed.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

#### 1.5 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 rigging instructions for handling.



## PART 2 - PRODUCTS

### 2.1 HIGH TEMPERATURE SUBMERSIBLE SUMP PUMPS

#### A. Submersible, Fixed-Position, High Temperature Sump Pumps:

1. Description: Factory-assembled and -tested sump-pump unit.
2. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
3. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
4. Impeller: Statically and dynamically balanced, ASTM B 584, cast bronze design for clear wastewater handling, and keyed and secured to shaft.
5. Pump and Motor Shaft: Steel with factory-sealed, grease-lubricated ball bearings.
6. Seal: Mechanical.
7. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
  - a. Motor Housing Fluid: Oil.
8. Temperature Rating: Rated for continuous contact up to 200°F.
  - a. High temperature liquid-tight conduit used with high temperature cable.
  - b. High temperature motor windings.
  - c. High temperature Viton gaskets
  - d. High temperature thermal overload protected
9. Controls:
  - a. Enclosure: NEMA 250, Type 1; wall mounted.
  - b. Switch Type: Mechanical-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
  - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
  - d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float switch matching control and electric bell; 120 V ac, with transformer and contacts for remote alarm bell.
10. Control-Interface Features:
  - a. Remote Alarm Contacts: For remote alarm interface.

- b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
  - 1) On-off status of pump.
  - 2) Alarm status.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with manufacturer's installation instructions.
- B. Provide union and check valve at pump discharge.
- C. Install piping adjacent to equipment to allow service and maintenance.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Pumps and controls will be considered defective if they do not pass tests and inspections.

### 3.3 STARTUP SERVICE

- A. Perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

### 3.4 ADJUSTING

- A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust control set points.

END OF SECTION 221429

## SECTION 230500 - GENERAL MECHANICAL REQUIREMENTS

### 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 and all Division 23 Sections.

#### 1.2 PLANS AND SPECIFICATIONS

- A. All work under this title, on drawings or specified, is subject to the general and special contract conditions for the entire project, and the contractor for this portion of the work is required to refer especially thereto, and to the architectural drawings.
- B. Drawings are diagrammatic and specifications are complementary and must be so interpreted to determine the full scope of work under this heading. Wherever any material, article, operation or method is either specified or shown on the drawings, this contractor is required to provide each item and perform each prescribed operation according to the designate quality, qualification or condition, furnishing all necessary labor, equipment or incidentals.
- C. Wherever the designation "Architect" appears, it shall imply Architect or Engineer. Wherever the term "Contractor" or "MC" appears, it shall imply the Contractor responsible for Division 23, Mechanical Work.

#### 1.3 CONFLICTS

- A. If, in the interpretation of contract documents, it appears that the drawings and specifications are not in agreement, the Contractor is to contact the Engineer. The Engineer shall be the final authority. Addenda supersede the provisions which they amend.
- B. In the absence of a written clarification by the engineer, the Contractor must install his work in accordance with the more stringent and/or costly condition. Contractor assumes full responsibility for any and all items furnished and installed without the written approval by the Architect or Engineer. Under no circumstances will a change order be approved for work installed that was not approved by the Architect or Engineer.

#### 1.4 DIMENSIONS, LAYOUTS AND OBSTACLES

- A. Verify dimensions and elevations from actual field measurements after building construction has sufficiently progressed.
- B. Assume full and final responsibility for the accuracy of any or all work performed under this Division and make repairs and corrections as required or directed at no extra cost to the Owner.
- C. Layouts of piping, ductwork, and equipment shown on drawings are diagrammatic and shall be construed as such. **DO NOT SCALE DRAWINGS.** Contractor shall field verify all existing conditions prior to fabrication and installation of material. It is recommended that the contractor verify all existing conditions prior to submitting a proposal. Lack of field verification does not constitute a basis for additional monies during construction. Contractor assumes full responsibility for completeness of installation including coordination of work with other trades.
- D. Make actual installations in accord with said layouts, but with necessary deviations as directed or required by job conditions and field measurements in order to produce a thoroughly integrated and practical job upon completing but make deviations only with specific approval of the Engineer/Architect.
  - 1. Take particular care to coordinate all piping and ductwork under this Division to prevent conflict and remove and relocate work as may be made necessary by such conflict at no extra cost to the Owner.
  - 2. Unless expressly permitted by the Engineer/Architect or shown otherwise on the Drawings, all piping, ducts and similar items shall be installed so that they are concealed except as permitted by the Engineer/Architect in service rooms noted on the Drawings.
- E. The Owner or Owner's Representative reserves the right to relocate terminal equipment six (6) feet in any direction from locations indicated on plans, before roughing-in, with no change in contract price.

#### 1.5 REVIEW OF MATERIAL

- A. Items specified have been checked by the Engineer for performance and space limitation.
- B. In order for Engineer to consider "equal", Contactor must certify by letter that he has checked the product for conformance to specifications and space limitations and assumes full responsibility thereafter.
- C. Engineer, not Contractor or Vendor, shall be the final judge of equal materials.

- D. Substitutions are defined as any manufacturer and/or model not indicated in drawings or specifications. Requests for substitutions must be made in writing ten (10) days prior to bid date so that an addendum may reach all contractors.
- E. If substitutions are proposed after the bids are received, the Contractor shall state amount of credit to the Owner for substitution. Substitutions that are considered equal by the Contractor and carried in bid without approval by Engineer shall be the responsibility of the Contractor. The Engineer and/or Owner shall not be made liable or responsible for losses incurred by the Contractor, due to the rejection of said items for installation.
- F. Where equipment requiring different arrangement or connections other than as indicated is acceptable, it shall be the responsibility of this Contractor to furnish revised layouts and install the equipment to operate properly and in harmony with the intent of the drawings and specifications. All changes in the work required by the different arrangement shall be done at no additional cost to the Owner, including but not limited to structural steel modifications. Control and power wiring modifications required by Contractor, imposed modifications, and the additional cost of these modifications, shall be the responsibility of this Contractor.
- G. Upon review of equipment list by Engineer, copies of submittal prints shall be forwarded to Engineer within 30 days.

#### 1.6 PERMITS, CODES AND ORDINANCES

- A. The Contractor shall arrange and pay for all permits, inspections, etc., as required by local utilities or applicable agencies.
- B. All work and material shall be in complete accordance with the ordinances, regulations, codes, etc., of all political entities exercising jurisdictions, specifically including the NYS Energy Code.

#### 1.7 COORDINATION WITH OTHER TRADES

- A. Check mechanical drawings with all other trades including electrical, plumbing, fire protection and general construction.
- B. Anticipate and avoid interferences with other trades.
- C. Take particular care to coordinate all piping, ductwork, plumbing and major electrical components above ceiling, to prevent conflict. Remove and relocate work as may be made necessary by such conflict, at no extra cost to the Owner. The use of coordination drawings is recommended but may not be required (refer to Division 1 for additional requirements). Lack of coordination drawings assumes contractor has verified and coordinated all work associated with installation.

- D. Obtain decision for approval from project Engineer for proposed group installation before proceeding, and for clearance in structure and finish of the building.
- E. Verify with drawings all ductwork and equipment layout in concealed areas.
- F. Running pipe and ductwork over electrical equipment and in elevator machine rooms is prohibited.
- G. The Contractor to coordinate with, receive and install, Owner furnished equipment where indicated.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery of Materials: Make provisions for delivery and safe storage of all materials. Check and properly receipt material to be "furnished by others" to contractor and assume full responsibility for all materials while in storage with full visible identification and information.

#### 1.9 PROJECT CONDITIONS

- A. Existing Conditions: Field verify existing conditions that will determine exact locations, distances, levels, dimensions, elevations, etc. Review all drawings of other trades and report any conflicts to the Architect/Engineer which will affect the project cost. Lack of field verification does not constitute a basis for additional monies during construction. Contractor assumes full responsibility for completeness of installation including coordination of work with other trades.
- B. The existing facility will be occupied and functioning during the entire duration of construction. Care shall be taken when working in or around occupied spaces. There will be no interruption in mechanical systems or utilities without written approval from the Owner.

#### 1.10 MISCELLANEOUS SUPPORT

- A. Mechanical Contractor is responsible for providing all miscellaneous support components necessary for properly supporting equipment including hangers, rods, anchors, steel, etc.

END OF SECTION 230500

## SECTION 230502 - MECHANICAL DEMOLITION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Description of Work: Provide mechanical removal work as indicated and as required for removal and/or abandonment of systems, equipment and devices, etc. made obsolete by this Project, and as required for removal and remodeling by other trades.

#### 1.2 EXISTING CONDITIONS

- A. General: In general, existing mechanical systems, equipment and devices are not shown on the Drawings unless pertinent to the demolition and/or remodeling work. Existing conditions, where indicated, are based on casual field observations and/or historical plans prepared as part of original building fit-out and must be verified. Report any discrepancies to the Engineer before disturbing the existing installation.
- B. Examination: Prior to bidding, examine the site to determine all actual observable conditions. No additional compensation will be granted on account of extra work made necessary by the Contractor's failure to investigate such existing conditions.

#### 1.3 COORDINATION

- A. Adjoining Areas: It is expected that the Contractor understands that adjoining areas of the building (or project site) must remain in operation and mechanical systems and services must remain in operation at all times, unless specifically approved otherwise.
- B. Scheduling: Mechanical removal work shall be scheduled in conjunction with the other trades. Contractor cooperation will be expected under all conditions.
- C. Area Limits: Construction traffic and removal of debris will be limited to specific areas and routes. Confirm with the Owner.

#### 1.4 ADJACENT MATERIALS

- A. Protection: During execution of removal work, primary consideration shall be given to protecting from damage, building structure, furnishings, finishes and the like, which are not specifically indicated to be removed.



- B. Repairs: Existing items or surfaces to remain, which are damaged as a result of this work shall be refinished, repaired or replaced to the satisfaction of the Owner, at no cost to the Contract.

## 1.5 TRANSIENT SERVICES

- A. Locate and identify any and all mechanical services passing through the project area which serve areas outside the work limits.
- B. Maintain all mechanical services to areas outside the work limits unless specifically authorized otherwise in writing by the Engineer or Owner's Representative. When transient services must be interrupted, provide temporary services for affected areas outside the work limits.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Patching: Materials used for patching shall be in conformance with the applicable sections of the Project Manual. Where materials are not specifically described, but required for proper completion of the Work, they shall be as selected by the Contractor, subject to approval of the Engineer.

## PART 3 - EXECUTION

### 3.1 INSPECTION/VERIFICATION

- A. Inspection: Before commencing work of this Section, carefully inspect the project site and become familiar with existing systems and conditions.
- B. Items to be Salvaged: Verify with the Engineer and Owner's Representative, all systems, materials and equipment which are to be salvaged, and those which must be removed. The Owner reserves the right to salvage any or all existing mechanical materials and equipment at the project site. Items to be salvaged include, but are not limited to, the following:
  - 1. [insert specific items here].

### 3.2 COORDINATION

- A. Coordinate removal work with other trades, where applicable.

### 3.3 DEMOLITION

- A. General: Remove mechanical equipment, ductwork, piping, controls and related materials within the project work limits, as indicated.
- B. Disconnections: Disconnect all electrical devices and equipment located in wall, ceilings or floors scheduled for removal and other equipment, as indicated. Disconnect electrical connections to mechanical and other equipment being removed by other trades.
- C. Protection: Perform all removal work in such a manner so that damage to adjacent items and surfaces is minimized.
- D. Patching: When mechanical materials are removed, patch and finish surfaces to remain to match surrounding surfaces.

### 3.4 EXISTING MECHANICAL WORK TO REMAIN

- A. General: Protect and maintain access to existing mechanical work which must remain. Reinstall existing mechanical work disturbed.
- B. Reconnections: Where mechanical work in adjoining areas or mechanical work indicated to remain, becomes disconnected or affected by demolition work, reconnect as required, to restore original operation. Restoration work to comply with requirements for new work.

### 3.5 EXISTING MECHANICAL WORK TO BE RELOCATED

- A. General: Disconnect, remove, reinstall and reconnect existing equipment indicated to be relocated and where require to accommodate remodeling or new construction. Extend existing installations as required. Materials and methods used for relocations and extensions to conform to requirements for new work.

### 3.6 SHUTDOWNS

- A. General: All shutdowns to existing mechanical services to be scheduled and approved, in writing, by the Owner.

### 3.7 DISPOSITION OF EXISTING MATERIALS AND EQUIPMENT

- A. Items to Salvage: Material and equipment which is indicated (or directed by Owner) to be salvaged, shall be carefully removed and stored where directed on the site.
- B. Items to Reuse/Relocate: Carefully remove and store on site, all material and equipment indicated to be reused or relocated. Thoroughly clean, and make any necessary minor repairs to such equipment, prior to installation.

- C. Items to Remove: Remove and legally dispose of all other materials and debris resulting from demolition work on a daily basis.

### 3.8 CLEANING

Remove from the Project Site all dirt, dust and debris resulting from removal operations on a daily basis. Refuse shall not be allowed to block or otherwise impair circulation in corridors, stairs, sidewalks, roadways or other traffic areas.

END OF SECTION 230502

## SECTION 230529 – SUPPORTS AND SLEEVES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Perform all Work required to provide and install supports, hangers, anchors, sleeves and bases for all pipe, duct, equipment, system components and accessories, indicated by the Contract Documents with all supplementary items necessary for complete, code compliant and approved installation

#### 1.2 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and Workmanship shall comply with the applicable requirements and standards addressed within the following references:
  - 1. International Mechanical Code.
  - 2. International Plumbing Code.
  - 3. International Fuel Gas Code.
  - 4. ASME B31.2 - Fuel Gas Piping.
  - 5. ASME B31.9 - Building Services Piping.
  - 6. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
  - 7. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
  - 8. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
  - 9. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
  - 10. MSS SP-90 - Guidelines on Terminology for Pipe Hangers and Supports.
  - 11. NFPA 13 - Installation of Sprinkler Systems.
  - 12. NFPA 14 - Installation of Standpipe and Hose Systems.
  - 13. NFPA 99 - Standard for Health Care Facilities.
  - 14. UL 203 - Pipe Hanger Equipment for Fire Protection Service.
  - 15. SMACNA - HVAC Duct Construction Standards.
  - 16. Underwriters Laboratories Standards and Listings.

#### 1.3 QUALITY ASSURANCE

- A. Materials and application of pipe hangers and supports shall be in accordance with MSS-SP-58 and SP-69 unless noted otherwise.

- B. Support and sleeve materials and installation shall not interfere with the proper functioning of equipment.
- C. Contractor shall be responsible for structural integrity of all hangers, supports, anchors, guides, inserts and sleeves. All structural hanging materials shall have a minimum safety factor of five.
- D. Installer Qualifications: Utilize an installer experienced in performing Work of this Section who is experienced in installation of Work similar to that required for this Project and per the minimum requirements of MSS SP-89. Field welding of supports shall be by certified welders qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX using welding procedures per the minimum requirements of MSS SP-58.

#### 1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog data including code compliance, load capacity, and intended application.
- B. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.
- C. Shop Drawings: Submit detailed Drawings of all shop or field fabricated supports, anchors and sleeves, signed and sealed by a qualified State of New York registered professional engineer. Indicate size and characteristics of components and fabrication details and all loads exceeding 750 pounds imposed on the base building structure.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Maintain in place until installation.
- C. Store materials protected from exposure to harmful weather conditions.

### PART 1 - PRODUCTS

#### 1.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

## 1.2 MANUFACTURERS

### A. Hangers and Supports:

1. Anvil International.
2. Kinder.
3. Cooper B-Line.
4. C & S Mfg. Corp.
5. Hubbard Enterprises/Holdrite
6. National Pipe Hanger Corporation.
7. Power Strut.

## 1.3 HANGERS AND SUPPORTS

### A. General:

1. Refer to individual system and equipment Specification Sections for additional support requirements. Comply with MSS SP-69 for support selections and applications that are not addressed within these Specifications.
2. Utilize hangers and supports to support systems under all conditions of operation, allowing free expansion and contraction, and to prevent excessive stresses from being introduced into the structure, piping or connected equipment.
3. Wire or perforated strap iron will not be acceptable as hanger material.
4. Hanger rods shall be threaded on both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.
5. Fasteners requiring explosive powder (shooting) or pneumatic-driven actuation will not be acceptable under any circumstances.
6. Plastic anchors or plastic expansion shields will not be permitted under any circumstances.
7. Field fabricated supports shall be constructed from ASTM A36/A36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

- B. Finishes: All ferrous hangers, rods, inserts, clamps, stanchions, and brackets on piping within interior non-corrosive environments, shall be dipped in Zinc Chromate Primer before installation. Rods may be galvanized or cadmium plated after threading, in lieu of dipping zinc chromate. All hangers and supports exposed to the weather, including roofs and building crawl space areas, shall be galvanized or manufactured from materials that will not rust or corrode due to moisture. All hangers and supports located within corrosive environments shall be constructed from or coated with materials manufactured for installation within the particular environment.

- C. Trapezes: Where multiple lines are run horizontally at the same elevation and grade, they may be supported on manufactured channel, suspended on rods or pipes. Trapeze

members including suspension rods shall be properly sized for the quantity, diameters, and loaded weight of the lines they are to support.

- D. Ductwork: All ductwork shall be supported in accordance with SMACNA recommendations for the service involved. Horizontal ducts supported using galvanized steel bands shall extend up both sides and onto the construction above, where they shall turn over and be secured with bolts and nuts fitted in inserts set in the concrete, bolted to angles secured to the construction above, or secured in another approved manner.
- E. Terminal Units:
1. Terminal units weighing up to 150 pounds shall be supported by four (4) 1 inch wide sheet metal straps with ends turned under bottom of unit at corners.
  2. Each band shall be secured by not over 3/4 inch in length, 1/4 inch diameter sheet metal screws – two (2) on bottom of unit and one (1) on each side.
  3. The other strap end shall be attached to the structure by 1/4 inch diameter threaded bolt into the concrete insert or into drilled-hole threaded concrete expansion anchor.
  4. Where interference occurs, overhead of the box, not allowing direct vertical support by straps, provide trapeze channels suspended by 1/4 inch diameter galvanized threaded rods providing such channels do not block access panels of units.
  5. Terminal units weighing more than 150 pounds shall be supported per the terminal unit manufacturer's installation instructions using threaded rod and hanger brackets located per manufacturer's drawing.

#### 1.4 DUCT PENETRATIONS

A. General:

1. Seal penetrations through all rated partitions, walls and floors with U.L. tested assemblies to provide and maintain a rating equal to or greater than the partition, wall or floor.
2. Inside diameter of all sleeves or cored holes shall provide sufficient annular space between outside diameter of duct or insulation to allow proper installation of required fire and water proofing materials and allow for movement due to expansion and contraction.

B. Wall Penetrations:

1. Where ductwork passes through non-rated partition, close off space between duct and construction with gypsum wallboard and repair plaster smoothed and finished to match adjacent wall area.
2. Ductwork penetrations through rated partitions, walls and floors shall be provided with sleeves that are manufactured integral with the damper assembly installed.

C. Flashing:

1. Coordinate flashing material and installation required for pipe and duct roof penetrations with Owner and roofing Contractor.
2. Provide flexible flashing and metal counter-flashing where ductwork penetrates exterior walls. Seal penetration water and air tight.
3. Provide acoustical flashing around ducts penetrating equipment rooms, with materials and installation in accordance with manufacturer's instructions for sound control.

D. Roof Curbs: Coordinate roof curb material and installation with Owner and roofing Contractor.

PART 2 - EXECUTION

2.1 PREPARATION

- A. Conduct a pre-installation meeting prior to commencing Work of this Section to verify Project requirements, coordinate with other trades, establish condition and completeness of substrate, review manufacturer's installation instructions and manufacturer's warranty requirements.

2.2 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. Application, sizing and installation of supports, anchors and sleeves shall be in accordance with manufacturer's printed installation instructions.
- C. Install hanger so that rod is vertical under operating conditions.
- D. Supports, hangers, anchors, and guides shall be fastened to the structure only at such points where the structure is capable of restraining the forces in the piping system.
- E. The load and spacing on each hanger and/or insert shall not exceed the safe allowable load for any component of the support system, including the concrete that holds the inserts. Reinforcement at inserts shall be provided as required to develop the strength required. Contractor shall be responsible for engaging a structural engineer as required for design and review at support systems.
- F. Do not hang duct or any mechanical/plumbing item directly from a metal deck or locate on the bottom chord of any truss or joist unless approved by the Structural Engineer of Record.



- G. All supports shall be designed and installed to avoid interference with other piping, hangers, ducts, electrical conduit, supports, building structures, equipment, etc.
- H. Piping supports shall be independent from ductwork supports. Combining supports is not permitted.
- I. Provide all supporting steel required for the installation of mechanical equipment and materials, including angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may not be specifically indicated on the Drawings.
- J. All ductwork supports shall be designed and installed to allow the insulation to be continuous through the hangers.
- K. All hanger rods shall be trimmed neatly so that 1 inch of excess hanger rod protrudes beyond the hanger nut. In the event a rod is intentionally but temporarily left excessively long (for sloped or insulated lines for example), the Contractor shall take appropriate measures to protect the pipe or other materials from damage.
- L. Install hangers to provide minimum ½ inch space between finished covering and adjacent structures, materials, etc.
- M. Flashing:
  - 1. Coordinate all roof flashing with requirements of Division 07.

END OF SECTION 230529

## SECTION 230719 - PIPE INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes insulating the following mechanical piping systems:

- 1. Heating hot-water piping.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- 1. Include insulation schedule indicating applications and methods of compliance with specified performance.

#### 1.3 COORDINATION

- A. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### 1.4 SCHEDULING

- A. Schedule insulation application after pressure and leak testing systems. Insulation application may begin on segments that have satisfactory test results.

### PART 2 - PRODUCTS

#### 2.1 PIPE INSULATION SCHEDULE

- A. Heating Hot Water Piping: Insulation Type A.

- 1. Pipe Sizes less than 1.5 NPS: 1.5-inches thick.
  - 2. Pipe Sizes 1.5 NPS and larger: 2-inches thick.
  - 3. Pre-Molded PVC Fitting Covers; Zeston or equal.
  - 4. Provide high impact strength PVC pipe jacketing for piping exposed in finished spaces.

#### 2.2 PIPE INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following. No substitutions will be permitted without written approval prior to receipt of bids:
  - 1. CertainTeed Corp.
  - 2. Johns Manville.
  - 3. Knauf Insulation.
  - 4. Manson Insulation Products Ltd.
- C. Pipe insulating materials shall be as follows:
  - 1. Type A: Fiberglass pipe insulation jacketed with a reinforced white all service vapor retarder jacket (ASJ) and factory applied longitudinal acrylic adhesive closure system. UL rated for maximum flamespread 25 and smoke developed 50.
    - a. Thermal Conductivity: 0.23 (Btu-in./h-sf) at 75F mean temperature.
- D. High Impact Strength Jacketing: Furnish PVC jacketing and fitting covers, conforming to ASTM E-84; flame spread 25, smoke developed 50, white high gloss finish, 0.02" minimum thickness.
- E. Furnish pre-molded PVC jacketing and fitting covers, lo-smoke type, as manufactured by Proto Corp.; or an approved equal.
  - 1. PVC: Conform with FS L-P-535C, Composition A, Type II, Grade GU.
  - 2. Fiberglass: Conform with FS HH-I-558C, Form B, Type I, Class 7&8.
  - 3. Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Zeston.
    - b. Proto Corporation; LoSmoke.
    - c. Speedline Corporation; SmokeSafe.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Comply with the manufacturer's installation instructions.

#### 3.2 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. 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.

C. 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."

3.3 INSTALLATION OF FIBERGLASS INSULATION

- A. Insulation on all cold surfaces must be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.

3.4 INSTALLATION AT HANGERS

- A. Reset and realign hangers and supports if they are displaced while installing the piping insulation.
- B. Fiberglass Insulation: Install high density insulation filler pieces, at all points of support, between pipe insulation shields and pipe or tubing not supported by an insulation shield and insulating saddle unit. Do not install high density insulation filler pieces on hot service piping 6" and larger scheduled to have steel saddles. Install filler pieces of the same thicknesses as adjoining pipe insulation x 12" length.
1. Install high density molded polyurethane or high-density polystyrene filler pieces.
- C. Galvanized metal shields shall be applied between hangers or supports and the pipe insulation. Shields shall be formed to fit the insulation and shall extend up to the centerline of the pipe and 8" length.

END OF SECTION 230719

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## SECTION 232113 – HYDRONIC PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
  - 1. Pipe and pipe fittings.
  - 2. Valves.
  - 3. Hydronic specialties.
  - 4. Meters and gages.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Pressure-seal fittings.
  - 2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
  - 3. Air control devices.
  - 4. Hydronic specialties.
  - 5. Meters and gages.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Welding certificates.
- C. Field quality-control test reports.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

## 1.5 QUALITY ASSURANCE

### A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

- ### B. ASME Compliance:
- Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

- #### A. Drawn-Temper Copper Tubing:
- ASTM B 88, Type L.

- #### B. Annealed-Temper Copper Tubing:
- ASTM B 88, Type K.

- #### C. Wrought-Copper Fittings:
- ASME B16.22.

- #### D. Copper or Bronze Pressure-Seal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Stadler-Viega.
2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

### 2.2 STEEL PIPE AND FITTINGS

- #### A. Steel Pipe:
- Schedule 40 ASTM A 53/A 53M, black steel.

- #### B. Grooved Mechanical-Joint Fittings and Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Anvil International, Inc.
- b. Victaulic Company.
2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

## 2.3 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 minimum at 180 deg F.
    - 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 minimum at 180 deg F.
    - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

## 2.4 BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
  1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-585-70-66 or T-585-70-66 or a comparable product by one of the following:



- a. Conbraco Industries, Inc.; Apollo Div.
- b. Jamesbury, Inc.
- 2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.
  - e. Body Material: Bronze ASTM B 584 Alloy C844.
  - f. Ends: Threaded or Solder.
  - g. Seats: PTFE or TFE.
  - h. Stem: 316 stainless steel.
  - i. Ball: 316 stainless steel, vented.
  - j. Port: Full.

## 2.5 DUCTILE IRON, SINGLE-FLANGE BUTTERFLY VALVES

- A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model LD-2000-3/5 & LD-1000-5, or a comparable product by one of the following:
    - a. Cooper Cameron Corp.; Cooper Cameron Valves Div.
    - b. Tyco International, Ltd.; Tyco Valves & Controls
  - 2. Description:
    - a. Standard: MSS SP-67, Type I.
    - b. NPS 12 and Smaller CWP Rating: 200 psig.
    - c. NPS 14 and Larger CWP Rating: 150 psig.
    - d. Body Design: Full Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
    - e. Body Material: ASTM A 536, ductile iron.
    - f. Seat: EPDM.
    - g. Stem: One- or two-piece stainless steel.
    - h. Disc: Aluminum bronze.

## 2.6 DUCTILE IRON, GROOVED-END BUTTERFLY VALVES

### A. 300 CWP, Iron, Grooved-End Butterfly Valves with EPDM Disc:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model GD-4765-3/5, or a comparable product by one of the following:
  - a. Tyco International, Ltd.; Tyco Valves & Controls.
  - b. Victaulic Company.
2. Description:
  - a. Standard: MSS SP-67, Type I.
  - b. NPS 8 and Smaller CWP Rating: 300 psig.
  - c. NPS 10 and Larger CWP Rating: 200 psig.
  - d. Body Material: Polyamide Coated, ductile iron ASTM A 395.
  - e. Stem: Two-piece stainless steel.
  - f. Disc: EPDM-Encapsulated, ductile iron.
  - g. Seal: EPDM.

## 2.7 BRONZE LIFT CHECK VALVES

### A. Class 125, Lift Check Valves with Nonmetallic TFE Disc:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model S-480-Y or T-480-Y or a comparable product by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Powell Valves.
2. Description:
  - a. Standard: MSS SP-80, Type 2.
  - b. CWP Rating: 250 psig (1725 kPa).
  - c. Body Design: Vertical flow.
  - d. Body Material: ASTM B 584 Alloy C844, bronze.
  - e. Ends: Threaded or Solder.
  - f. Disc: PTFE, or TFE.

## 2.8 IRON, CENTER-GUIDED CHECK VALVES

### A. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model F-910-B, or a comparable product by one of the following:
  - a. Metraflex Co.
  - b. Val-Matic Valve & Manufacturing Corp.
2. Description:
  - a. Standard: MSS SP-125, FCI 74-1 and MIL-V-18436F.
  - b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
  - c. Body Material: ASTM A 48, gray iron.
  - d. Style: Globe, spring loaded.
  - e. Ends: Flanged.
  - f. Seat: Buna-N.

## 2.9 IRON, PLATE-TYPE CHECK VALVES

### A. Class 125, Iron, Single-Plate Check Valves with Resilient Seat:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model W-920-W, or a comparable product by one of the following:
  - a. Metraflex Co.
  - b. Val-Matic Valve & Manufacturing Corp.
2. Description:
  - a. Standard: ANSI B 16.1.
  - b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
  - c. Body Design: Wafer, spring-loaded plate.
  - d. Body Material: ASTM A 126, gray iron.
  - e. Seat: Buna-N.

## 2.10 BALANCING VALVES

### A. Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong Pumps, Inc.
  - b. Bell & Gossett Domestic Pump; a division of ITT Industries.
  - c. Taco.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

## 2.11 AIR CONTROL DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.

- B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

- C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.

3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

D. Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

E. Tangential-Type Air Separators:

1. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature.
2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
3. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
4. Blowdown Connection: Threaded.
5. Size: Match system flow capacity.

## 2.12 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40 -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40 -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

2.13 METERS AND GAGES

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Ashcroft Inc., Trerice, H. O. Co., Weiss Instruments, Inc.
2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
6. Dial: Non-reflective aluminum with permanently etched scale markings graduated in deg F.
7. Scale Range for Heating Hot Water Piping: 30 to 240 deg F.
8. Pointer: Dark-colored metal.
9. Window: Glass.

10. Ring: Stainless steel.
  11. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
  12. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
  13. Accuracy: Plus or minus 1 percent of scale range.
- B. 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.
  4. Material for Use with Steel Piping: CRES.
  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.
- C. Heat-Transfer Medium: Mixture of graphite and glycerin.
- D. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: AMETEK, Inc.; U.S. Gauge; Ashcroft Inc.; Terice, H. O. Co.; Weiss Instruments, Inc.; WIKA Instrument Corporation - USA.
  2. Standard: ASME B40.100.
  3. Case: Sealed 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, 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. Scale Range for Heating Hot Water Piping: 0 to 100 psi.
9. Pointer: Dark-colored metal.
10. Window: Glass.
11. Ring: Stainless steel.
12. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

E. Gage Attachments

1. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
2. Valves: Ball valve NPS 1/4.

F. Test Plugs

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Flow Design, Inc.; Peterson Equipment Co., Inc.; Trerice, H. O. Co.; Weiss Instruments, Inc.
2. Description: Test-station fitting made for insertion into piping tee fitting.
3. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
4. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.
5. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
6. Core Inserts: EPDM self-sealing rubber.

G. Test-Plug Kits

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Flow Design, Inc.; Peterson Equipment Co., Inc.; Trerice, H. O. Co.; Weiss Instruments, Inc.
2. Furnish two (2) test-plug kits containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.



3. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
4. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.
5. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.
6. Carrying Case: Metal or plastic, with formed instrument padding.

### PART 3 - EXECUTION

#### 3.1 PIPING APPLICATIONS

- A. Aboveground, NPS 2.5 and smaller, shall be the following:
  1. Type L, drawn-temper copper tubing, wrought-copper fittings, and pressure-seal joints.
- B. Aboveground, NPS 3 and larger, shall be the following:
  1. Schedule 40 black steel with grooved fittings and mechanical couplings.
- C. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

#### 3.2 VALVE APPLICATIONS

- A. Install shut off-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

#### 3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using [mechanically formed] tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- R. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

- S. Install sleeves for piping penetrations of walls, ceilings, and floors.

### 3.4 HANGERS AND SUPPORTS

- A. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping.
  - 2. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- B. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
  - 2. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  - 3. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
  - 4. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.
- C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- D. Support vertical runs at roof, at each floor, and at 8-foot intervals between floors.

### 3.5 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

- C. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.
- D. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

### 3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.

### 3.7 PIPE CLEANING AND INITIAL FILL

- A. Clean piping systems with a 1% to 2% solution of trisodium phosphate in water prior to the installation of heat transfer fluid. Circulate solution for a minimum of 24 hours, drain, and clean strainer screens.
- B. Upon completion of system commissioning work, submit fluid sample to manufacturer for analysis. Provide report indicating inhibitor and fluid concentrations are satisfactory.

### 3.8 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  3. Isolate expansion tanks and determine that hydronic system is full of water.
  4. Subject piping system to hydrostatic test pressure of 100 psig or 1.5 times the system working pressure, whichever is greater. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  5. After hydrostatic test pressure has been applied for at least 15 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
  6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
  2. Inspect pumps for proper rotation.
  3. Set makeup pressure-reducing valves for required system pressure.
  4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  5. Set temperature controls so all coils are calling for full flow.
  6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
  7. Verify lubrication of motors and bearings.

### 3.9 METERS AND GAGES

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells with extension on insulated piping.

- C. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- D. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- E. Install valve and snubber in piping for each pressure gage.
- F. Install test plugs in the following locations:
  - 1. Inlet and outlet of each hydronic coil.
  - 2. Inlet and outlet of each terminal unit.
  - 3. Where indicated on plans and details.

END OF SECTION 232113

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## SECTION 260500 – GENERAL ELECTRICAL REQUIREMENTS

### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. The General and Supplementary Conditions are a part of the requirements for the work under this Division of the Specifications.

#### 1.2 WORK INCLUDED

- A. Provide labor and materials required to install, test and place into operation the electrical systems as called for in the Contract Documents, and in accordance with applicable codes and regulations.
- B. Provide labor, materials, and accessories required to provide complete, operating electrical systems. Labor, materials or accessories not specifically called for in the Contract Documents, but required to provide complete, operating electrical systems shall be provided without additional cost to the Owner.

#### 1.3 QUALITY ASSURANCE

- A. Comply with the current applicable codes, ordinances, and regulations of the Authority or Authorities Having Jurisdiction, the rules, regulations and requirements of the utility companies serving the project, and the Owner's insurance underwriter.
- B. Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, the most stringent apply.
- C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Engineer prior to submitting bid.
- D. All electrical equipment, materials, devices and installations shall meet or exceed minimum requirements of ADA, ANSI, ASTM, IEEE, IES, NEC, NEMA, NETA, NFPA, OSHA, SMACNA, UL, and the State Fire Marshal.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, workperson-like manner by competent workpeople. Provide a competent, experienced, full-time Superintendent who is authorized to make decisions on behalf of the Contractor.



- F. Equipment shall be certified for use in the state of New York and shall meet the New York State energy code.

#### 1.4 ABBREVIATIONS AND DEFINITIONS

A. Abbreviations:

- |     |        |                                                                      |
|-----|--------|----------------------------------------------------------------------|
| 1.  | ADA    | Americans with Disabilities Act                                      |
| 2.  | ANSI   | American National Standards Institute                                |
| 3.  | ASA    | Acoustical Society of America                                        |
| 4.  | ASTM   | American Society for Testing and Materials                           |
| 5.  | BIL    | Basic Impulse Level                                                  |
| 6.  | CBM    | Certified Ballast Manufacturers                                      |
| 7.  | ECC    | Engineer's Control Center                                            |
| 8.  | EIA    | Electronic Industries Alliance                                       |
| 9.  | ETL    | Electrical Testing Laboratories, Inc.                                |
| 10. | FCC    | Fire Control Center                                                  |
| 11. | FM     | Factory Mutual                                                       |
| 12. | IEEE   | Institute of Electrical and Electronic Engineers                     |
| 13. | IES    | Illuminating Engineering Society                                     |
| 14. | IPCEA  | International Power Cable Engineers Association                      |
| 15. | LED    | Light Emitting Diode                                                 |
| 16. | NEC    | National Electric Code                                               |
| 17. | NEMA   | National Electrical Manufacturers Association                        |
| 18. | NETA   | National Electrical Testing Association                              |
| 19. | NFPA   | National Fire Protection Association                                 |
| 20. | OEM    | Original Equipment Manufacturer                                      |
| 21. | OSHA   | Occupational Safety and Health Administration                        |
| 22. | SCC    | Security Control Center                                              |
| 23. | SMACNA | Sheet Metal and Air Conditioning Contractors<br>National Association |
| 24. | TIA    | Telecommunications Industry Association                              |
| 25. | UL     | Underwriters Laboratories Inc.                                       |

B. Definitions:

1. Where it is stated in these specifications to submit to Engineer for review, refer to Architectural General and Supplementary Conditions for proper procedures.
2. FURNISH means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application.

3. INSTALL means to join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation.
4. PROVIDE means to FURNISH and INSTALL.
5. AS DIRECTED means as directed by the Engineer, or the Engineer's Representative.
6. CONCEALED means embedded in masonry or other construction, installed behind wall furring or within drywall partitions, or installed within hung ceilings.
7. SUBMIT means submit to Engineer for review.

## 1.5 GUARANTEE

- A. Submit a single guarantee stating that the work is in accordance with the Contract Documents. Guarantee work against faulty and improper material and workmanship for a period of one year from the date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are provided or specified herein, the longer term shall apply. Manufacturer's warranty/guarantee on equipment shall be begin at time of equipment startup not upon receipt of equipment. Correct any deficiencies, which occur during the guarantee period, within 24 hours of notification, without additional cost to the Owner, to the satisfaction of the Owner. Obtain similar guarantees from subcontractors, manufacturers, suppliers and subtrade specialists.

## PART 2 – PRODUCTS

### 2.1 EQUIPMENT AND MATERIALS

- A. Provide products and materials that are new, clean, free of defects, and free of damage and corrosion.
- B. Products and materials shall not contain asbestos, PCB, or any other material that is considered hazardous by the Environmental Protection Agency or any other Authority Having Jurisdiction.
- C. Replace materials of less than specified quality and relocate work incorrectly installed as directed by the Architect or Engineer at no additional cost to the Owner.
- D. Provide name/data plates on major components of equipment with manufacturer's name, model number, serial number, capacity data and electrical characteristics attached in a conspicuous place.

- E. Install materials and equipment with qualified trades people.
- F. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.
- G. Fully lubricate equipment where required.
- H. Follow manufacturer's instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.
- I. Where factory testing of equipment is required to ascertain performance, and attendance by the Owner's Representative is required to witness such tests, associated travel costs and subsistence shall be paid for by the Contractor.
- J. Equipment capacities, ratings, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be derated with the method of derating identified on the submittals.
- K. Enclosures for electrical equipment installed in mechanical and electrical equipment rooms shall be NEMA type 1 gasketed. Enclosures for electrical equipment installed outdoors shall be NEMA type 3R.
- L. Energy consuming equipment shall be certified for use in the state of New York and shall meet the New York State Energy Code and local energy ordinances.

## 2.2 SUBSTITUTIONS

- A. Contract Documents are based on equipment manufacturers as called out in the Specifications and indicated on the Drawings. Acceptance of substitute equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials, which meet the performance as, stated or implied in the Contract Documents.
- B. Submit proposals to provide substitute materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule. Reimburse Owner for costs associated with the review of the proposed substitution whether substitution is accepted or rejected.
- C. Indicate revisions required to adapt substitutions including revisions by other trades. Substitutions that increase the cost of the work and related trades are not permitted.

- D. The proposed substitution shall conform to the size, ratings, and operating characteristics of the equipment or systems as specified and shown on the Drawings.
- E. Proposals for substitutions shall include the following information:
  - 1. A description of the difference between the Contract Document requirements and that of the substitution, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on other contractors and acknowledge the inclusion of additional costs to the other trades.
  - 2. Schematic drawings and details.
  - 3. List of revisions to the Contract Documents that must be made if the substitution is accepted.
  - 4. Estimate of costs the Owner may incur in implementing the substitution, such as test, evaluation, operating and support costs.
  - 5. Statement of the time by which a Contract modification accepting the substitution must be issued, noting any effect on the Contract completion time or the delivery schedule.
  - 6. A statement indicating the reduction to the Contract price if the Owner accepts the substitution. Include required modifications to all related trades.

### PART 3 – EXECUTION

#### 3.1 FEES AND PERMITS

- A. Pay all required fees and obtain all required permits related to the electrical installation.
- B. Pay royalties or fees in connection with the use of patented devices and systems.
- C. Provide controlled inspection where required by Authorities Having Jurisdiction or by these specifications.

#### 3.2 SUBMITTALS AND REVIEWS

- A. Submit shop drawings, manufacturer's product data sheets, samples, and test reports as specified.
- B. After execution of Owner/Contractor Agreement, submit a complete typed list of all electrical equipment manufacturers and material suppliers for the equipment proposed to be provided on this project, as well as names of all subcontractors.

- C. After execution of Owner/Contractor Agreement, prepare an index of all submittals for the project. Include a submittal identification number, a cross-reference to the Specification sections or Drawing number, and an item description. Prefix the submittal identification number by the Specification sections to which they apply. Indicate on each submittal, the submittal identification number in addition to the other data specified. All subcontractors shall utilize the assigned submittal identification number.
- D. After the Contract is awarded, obtain complete shop drawings, product data and samples from the manufacturers, suppliers, vendors, and all subcontractors, for all materials and equipment as specified. Submit data and details of such materials and equipment for review. Prior to submission, certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Check all materials and equipment upon their arrival on the job site and verify their compliance with the Contract Documents. Modify any work, which proceeds prior to receiving accepted shop drawings as required to comply with the Contract Documents and the shop drawings.
- E. Review of submittals is for general compliance with the design concept and Contract Documents. Comments or absence of comments shall not relieve the Contractor from compliance with the Contract Documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.
- F. No part of the work shall be started in the shop or in the field until the shop drawings and samples for that portion of the work have been submitted and accepted.
- G. A minimum period of ten working days, exclusive of transmittal time, will be required in the Engineer's office each time a shop drawing, product data and/or samples are submitted for review. This time period must be considered by the Contractor in the scheduling of the work.
- H. Submit electronic copies, preferably in PDF format, of all items requiring shop drawings.
- I. Submit materials and equipment by manufacturer, trade name, and model number. Include copies of applicable brochure or catalog material. Maintenance and operating manuals are not acceptable substitutes for shop drawings.
- J. Identify each sheet of printed submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and

options actually being proposed. Cross out non-applicable information. Note specified features such as materials or paint finishes.

- K. Include dimensional data for roughing in and installation and technical data sufficient to verify that equipment meets the requirements of the Contract Documents. Include wiring, piping and service connection data.
- L. Maintain a complete set of reviewed and stamped shop drawings and product data on site.
- M. For each room or area of the building containing electrical equipment, submit the following:
  - 1. Floor Plans: Plan and elevation layout drawings indicating the equipment in the exact location in which it is intended to be installed. These plans shall be of a scale not less than 1/4 inch to 1 foot. They shall be prepared in the following manner:
    - a. Indicate the physical boundaries of the space including door swings and ceiling heights and ceiling types (as applicable).
    - b. Illustrate all electrical equipment proposed to be contained therein. Include top and bottom elevations of all electrical equipment. The Drawings shall be prepared utilizing the dimensions contained in the individual equipment submittals. Indicate code and manufacturer's required clearances.
    - c. Illustrate all other equipment therein such as conduits, detectors, luminaries, ducts, registers, pull boxes, wireways, structural elements, etc.
    - d. Indicate the operating weight of each piece of equipment.
    - e. Indicate the heat release from each piece of electrical equipment in terms of BTU per hour. This information shall be that which is supplied by the respective manufacturers.
    - f. Illustrate concrete pads, curbs, etc.
    - g. Indicate dimensions to confirm compliance with code-required clearances.
    - h. Indicate maximum normal allowable operating temperature for each piece of equipment (as per each respective manufacturer's recommendation).
    - i. Equipment removal routes.
- N. The work described in shop drawing submissions shall be carefully checked by all trades for clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and coordination with other trades on the job. Each submitted shop drawing shall include a certification

that related job conditions have been checked by the Contractor and each Subcontractor and that conflicts do not exist.

- O. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions, or for deviations from the requirements of the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superceded in any way by the review of shop drawings, product data and samples.
- P. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed and will be returned to the Contractor for resubmittal.

### 3.3 COORDINATION OF WORK

- A. The Contract Documents establish scope, materials and quality but are not detailed installation instructions. Drawings are diagrammatic.
- B. Coordinate work with related trades and furnish, in writing, any information necessary to permit the work of related trades to be installed satisfactorily and with the least possible conflict or delay.
- C. The electrical drawings show the general arrangement of equipment and appurtenances. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories, which may be required but not shown on the Drawings. Investigate the site, and review drawings of other trades to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.
- D. The locations of lighting fixtures, outlets, panels and other equipment indicated on the Drawings are approximately correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of outlets, or in order to meet field conditions, or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes.
- E. Exercise particular caution with reference to the location of panels, outlets, switches, etc., and have precise and definite locations accepted by the Engineer before proceeding with the installation.
- F. The Drawings show only the general run of raceways and approximate locations of outlets. Any significant changes in location of outlets, cabinets, etc., necessary

in order to meet field conditions shall be brought to the immediate attention of the Engineer for review before such alterations are made. Modifications shall be made at no additional cost to the Owner.

- G. Verify with the Architect the exact location and mounting height of outlets and equipment not dimensionally located on the Drawings prior to installation.
- H. Circuit tags in the form of numbers are used where shown to indicate the circuit designation numbers in electrical panels. Show the actual circuit numbers on the as-built Record Drawings and on the associated typed panelboard directory card. Where circuiting is not indicated, provide required circuiting in accordance with the loading indicated on the Drawings and/or as directed.
- I. The Drawings generally do not indicate the number of wires in conduit for the branch circuit wiring of fixtures and outlets, or the actual circuiting. Provide the correct wire size and quantity as required by the indicated circuiting and/or circuit numbers indicated, the control intent, referenced wiring diagrams (if any), the specified voltage drop or maximum distance limitations, and the applicable requirements of the NEC.
- J. Carefully check space requirements with other trades to ensure that equipment can be installed in the spaces allotted.
- K. Wherever work interconnects with work of other trades, coordinate with other trades to ensure that they have the information necessary so that they may properly install the necessary connections and equipment. Identify items (remote ballast, pull boxes, etc.) requiring access in order that the ceiling trade will know where to install access doors and panels.
- L. Consult with other trades regarding equipment so that, wherever possible, motor controls and distribution equipment are of the same manufacturer.
- M. Furnish and set sleeves for passage of electrical risers through structural masonry and concrete walls and floors and elsewhere as required for the proper protection of each electrical riser passing through building surfaces.
- N. Provide firestopping around all pipes, conduits, ducts, sleeves, etc. which pass through rated walls, partitions and floors.
- O. Provide detailed information on openings and holes required in precast members for electrical work.
- P. Provide required supports and hangers for conduit and equipment, designed so as not to exceed allowable loadings of structures.



- Q. Examine and compare the Contract Documents with the drawings and specifications of other trades and report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.
- R. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Engineer for review. At completion include a set of these drawings with each set of Record Drawings.
- S. Furnish services of an experienced Superintendent, who shall be in constant charge of all work, and who shall coordinate work with the work of other trades. No work shall be installed before coordinating with other trades.
- T. Coordinate with the local electric utility company and the local telecommunications company as to their requirements for service connections and provide all necessary metering provisions, grounding, materials, equipment, labor, testing, and appurtenances.
- U. Before commencing work, examine adjoining work on which this work is in any way affected and report conditions, which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- V. Adjust location of conduits, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication.
  - 1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
  - 2. Provide offsets, transitions and changes in direction of conduit as required to maintain proper headroom and pitch on sloping lines.
- W. In cases of doubt as to the work intended, or in the event of need for explanation, request supplementary instructions from the Engineer.

### 3.4 CONTRACTOR'S COORDINATION DRAWINGS

- A. The Contractor shall coordinate efforts of all trades and shall furnish (in writing, with copies to the Engineer) any information necessary to permit the work of all

trades to be installed satisfactorily and with the least possible interference or delay.

- B. The Contractor and all trade contractors shall prepare a complete set of construction Coordination Drawings indicating the equipment actually purchased and the exact routing for all lines such as busway, conduit, piping, ductwork, etc., including conduit embedded in concrete floors and walls. The Coordination Drawings shall be submitted complete to the Architect and the Engineer, within three months after notice to proceed is given, and in compliance with the construction schedule for the project. The sheet metal drawings, at a scale of not less than 1/4 inch to 1 foot, shall serve as the base drawings to which all other Contractors shall add their work. Each separate trade contractor shall draw their work on separate layers with different color assignments to facilitate coordination. Each Coordination Drawing shall be completed and signed off by the other Trade Contractors and the Contractor prior to the installation of the HVAC, plumbing, electrical and fire sprinkler work in the area covered by the specific drawing. The Contractor's work shall be installed according to the shop drawings and coordination drawings. If the Contractor allows one trade to install their work before coordination with the work of other trades, the Contractor shall make all necessary changes to correct the condition at no additional cost to the Owner.
- C. The Contractors' Coordination Drawings shall indicate structural loads at support points for all piping 10 inch and larger, racked piping, racked conduit, busway, and suspended electrical equipment. Submit to Structural Engineer for review and approval. The elevation, location, support points, static, dynamic and expansion forces and loads imposed on the structure at support and anchor points shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. Work routed underground or embedded in concrete shall be indicated by dimension to column and building lines and shall be coordinated. Coordination Drawings shall document all required structural penetrations for initial construction. Penetrations shall be dimensioned for walls, floors and roofs. These structural coordination requirements require review and approval by the Structural Engineer prior to completion and submittal of the Drawings.
- D. This requirement for Coordination Drawings shall not be construed as authorization for the Contractor or trade contractors to make any unauthorized changes to the Contract Documents. Contract document space allocations shall be maintained such as ceiling height, designated clearance for future construction and flexibility, chase walls, equipment room size, unless prior written authorization is received from the Engineer to change them.

- E. Prior to final acceptance of the Work, the Contractor shall submit the Coordination Drawings as part of the Record Drawings submittal.

### 3.5 EXAMINATION OF SITE

- A. Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.
- B. The Contract Documents do not make representations regarding the character or extent of the sub-soils, water levels, existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work. Evaluate existing conditions, which may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for the satisfactory completion of the work.

### 3.6 EXCAVATION AND BACKFILL

- A. Provide excavation for the work of this Division. Excavate all material encountered, to the depths indicated on the Drawings or as required. Remove from the site excavated materials not required or suitable for backfill. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water, which accumulates. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.
- B. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the depths indicated. Where rock excavations are required, excavate rock to a minimum overdepth of four inches below the trench depths indicated on the Drawings or required. Backfill overdepths in the rock excavation and unauthorized overdepths with loose, granular, moist earth, thoroughly machine-tamped to a compaction level of at least 95 percent to standard proctor density or 75 percent relative density or as specified by the Engineer. Whenever unstable soil that is incapable of properly supporting the work is encountered in the bottom of the trench, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.

- C. Excavate trenches for utilities that will provide the following minimum depths of cover from existing grade or from indicated finished grade, whichever is lower, unless otherwise specifically shown:
  - 1. Electric service: Three (3) feet minimum.
  - 2. Telephone service: Three (3) feet minimum.
  - 3. Cable TV service: Three (3) feet minimum
- D. Trenches should not be placed within ten feet of foundation or soil surfaces, which must resist horizontal forces.
- E. Do not backfill trenches until all required tests have been performed and installation observed by the Engineer. Comply with the requirements of other sections of the Specifications. Backfill shall consist of non-expensive soil with limited porosity. Deposit in six layers and thoroughly and carefully tamp until the work has a cover of not less than one foot. Backfill and tamp remainder of trench at one-foot intervals until complete. Uniformly grade the finished surface.

### 3.7 CUTTING AND PATCHING

- A. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finished plaster, woodwork, metalwork, etc., using skilled tradespeople of the trades required at no additional cost to the Owner.
- B. Do not cut, channel, chase or drill unfinished masonry, tile, etc., unless permission from the Architect is obtained. If permission is granted, perform this work in a manner acceptable to the Architect.
- C. Where conduit or equipment are mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.
- D. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Owner.

### 3.8 MOUNTING HEIGHTS

- A. Mounting heights shall conform to ADA requirements.
- B. Verify exact locations and mounting heights with the Architect before installation.

- C. Electrical and telecommunications outlets shall be mounted no higher than 48 inches above finished floor to top of the outlet box and no lower than 15 inches above finished floor to bottom of the outlet box.
- D. Electrical switches shall be mounted no higher than 48 inches above finished floor to top of the outlet box and no lower than 36 inches above finished floor to bottom of the outlet box.
- E. Fire alarm manual pull stations shall be mounted no higher than 48 inches above finished floor to top of the outlet box and no lower than 36 inches above finished floor to bottom of the outlet box.
- F. Outlets for public and other wall-mounted type telephones shall be installed so that the particular telephone installed conforms to ADA mounting height requirements.
- G. Visual Alarms: Mount not less than 80 inches to the bottom or 96 inches to the top of the device.
- H. Wall-Mounted Exit Signs: Two inches above top of door to bottom of sign.
- I. Low-Level Exit Signs: Six inches to bottom of sign.
- J. Stairwell and utility corridor wall-mounted lighting fixtures shall be mounted 8 feet-6 inches above finished floor or one foot below ceiling or structure above, whichever is lower.

### 3.9 CLEANING UP

- A. Avoid accumulation of debris, boxes, loose materials, crates, etc., resulting from the installation of this work. Remove from the premises each day all debris, boxes, etc., and keep the premises clean and free of dust and debris.
- B. Clean all fixtures and equipment at the completion of the project. Wipe clean exposed lighting fixture reflectors and trim pieces with a non-abrasive cloth just prior to occupancy.
- C. All electrical equipment shall be thoroughly vacuumed and wiped clean prior to energization and at the completion of the project. Equipment shall be opened for observation by the Engineer as required.

### 3.10 WATERPROOFING

- A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, make penetration prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
- B. Restore waterproofing integrity of walls or surfaces after they have been penetrated without additional cost to the Owner.

### 3.11 SUPPORTS

- A. Support work in accordance with the best industry practice. Provide supports, hangers, auxiliary structural members and supplemental hardware required for support of the work.
- B. Provide supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets and mechanical equipment rooms.
- C. Provide supporting frames or racks for equipment which is to be installed in a freestanding position.
- D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.
- E. Adequate support of equipment (including outlet, pull and junction boxes and fittings) shall not depend on electric conduits, raceways, or cables for support.
- F. Electrical equipment shall not rest on or depend for support on suspended ceiling media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling). Provide independent support of electrical equipment. Do not attach to supports provided for ductwork, piping or work of other trades.
- G. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure. Electrical equipment and supports shall not come in contact with work of other trades.

### 3.12 FASTENINGS

- A. Fasten equipment to building structure in accordance with the best industry practice.
- B. Where weight applied to building attachment points is 100 pounds or less, conform to the following as a minimum:
  - 1. Wood: Wood screws.
  - 2. Concrete and solid masonry: Bolts and expansion shields.
  - 3. Hollow construction: Toggle bolts.
  - 4. Solid metal: Machine screws in tapped holes or with welded studs.
  - 5. Steel decking or sub-floor: Fastenings as specified below for applied weights in excess of 100 pounds.
- C. Where weight applied to building attachment points exceeds 100 pounds, but is 300 pounds or less, conform to the following as a minimum:
  - 1. At concrete slabs provide 24-inch by 24-inch by 1/2-inch steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top of slab screed line, where no fill is to be applied.
  - 2. At steel decking or sub-floor for all fastenings, provide through bolts or threaded rods. The tops of bolts or rods shall be set at least one inch below the top fill screed line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or sub-floor manufacturer produces specialty hangers to work with their decking or sub-floor, such hangers shall be provided.
- D. Where weight applied to building attachment points exceeds 300 pounds, coordinate with and obtain the approval of Engineer and conform to the following as a minimum:
  - 1. Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.
- E. For items, which are shown, as being ceiling-mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.
- F. Wall-mounted equipment may be directly secured to wall by means of steel bolts. Groups or arrays of equipment may be mounted on adequately sized steel

angles, channels, or bars. Prefabricated steel channels as manufactured by Kindorf or Unistrut are acceptable.

### 3.13 IDENTIFICATION

- A. Identify electrical equipment with permanently attached black phenolic nameplates with 1/2-inch high white engraved lettering. Identification shall include equipment name or load served as appropriate. Nameplates for equipment connected to the emergency power system shall be red with white lettering. Nameplates shall be attached with cadmium-plated screws; peel-and-stick tape or glue-on type nameplates are not allowed.
- B. Cable tags shall be flameproof secured with flameproof non-metallic cord.
- C. Provide an engraved nameplate for each switch controlling loads, which are not local to the switch.
- D. Wherever raceways for future use are terminated outside of the building, stake the location with a 2-foot long, 1-inch by 1-inch clear heart redwood stake.
- E. See individual Sections for additional identification requirements.

### 3.14 PROHIBITED LABELS AND IDENTIFICATIONS

- A. In all public areas, the inclusion or installation of any equipment or assembly which bears on any exposed surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited, unless otherwise approved by Owner.
- B. Required UL labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

### 3.15 EQUIPMENT PADS AND ANCHOR BOLTS

- A. Provide concrete pads under all floor-mounted electrical equipment. Equipment pads shall conform to the shape of the piece of equipment it serves with a minimum 1-inch margin around the equipment and supports. Pads shall be a minimum of 4 inches high and made of a minimum 28 day, 2500 psi concrete reinforced with 6-inch by 6-inch 6/6 gauge welded wire mesh. Trowel tops and sides of pad to smooth finishes, equal to those of the floors, with all external corners bullnosed to a 3/4-inch radius.



- B. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Provide bolts of the size and number recommended by the manufacturer of the equipment and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured to the isolator. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation manufacturer.
- C. Where equipment is mounted on gypsum board partitions, the mounting screws shall pass through the gypsum board and securely attach to the partition studs. As an alternative, the mounting screws may pass through the gypsum board and be securely attached to 6 inches square, 18 gauge galvanized metal backplates, which are attached to the gypsum board with an approved non-flammable adhesive. Toggle bolts installed in gypsum board partitions are not allowed.

### 3.16 DELIVERY, DRAYAGE AND HAULING

- A. Provide drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and installation of equipment as required by the construction schedule. If any item of equipment is received prior to the time that it is required, the Contractor shall be responsible for its proper storage and protection until the time it is required. Pay for all costs of drayage or storage.
- B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, the Contractor shall be responsible for resulting disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc., at no additional cost to the Owner.

### 3.17 EQUIPMENT AND MATERIAL PROTECTION

- A. Protect the work, equipment, and material of other trades from damage by work or workmen of this trade, and correct damaged caused without additional cost to the Owner.
- B. Take responsibility for work, materials, and equipment until finally inspected, tested and accepted. Protect work against theft, injury, or damage, and carefully store material and equipment received on site, which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. Cover and protect equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc. Store equipment to moisture damage in dry, heated spaces.

- C. Provided adequate means for fully protecting finished parts of materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair.

### 3.18 TESTING OF ELECTRICAL SYSTEMS

- A. Comply with the project construction schedule for the date of final performance and acceptance testing, and complete work sufficiently in advance of the Contract completion date to permit the execution of the testing prior to occupancy and Contract close-out. Complete any adjustments and/or alterations, which the final acceptance tests indicate as necessary for the proper functioning of all equipment prior to the completion date. See individual Sections for extent of testing required.
- B. Provide a detailed schedule of completion indicating when each system is to be completed and outlining when field testing will be performed. Submit completion schedule for review within six months after the notice to proceed by Owner's Representative has been given. Update this schedule periodically as the project progresses.

### 3.19 OPERATING INSTRUCTIONS

- A. Provide the services of factory-trained specialists to provide an operating instructions seminar for equipment and systems. The seminar shall be conducted over a five-day (consecutive) period. Instruction time is defined as straight time working hours and does not include nights, weekends, or travel time to and from the project.
- B. Submit seminar agenda, schedule and list of representatives to the Owner for approval 30 days prior to suggested date of seminar. Do not commence seminar until the Owner has issued a written acceptance of the starting time and attendees. Confirm attendance of seminar by written notification to participants.
- C. Instruct Owner's operating personnel in proper starting sequences, operation, shut-down, general maintenance and preventative maintenance procedures, including normal and emergency procedures.
- D. Submit final copies of Record Drawings and Operating and Maintenance Manuals to Owner at seminar.

- E. Submit a written record of minutes and attendees of the seminar to the Owner.

### 3.20 OPERATING AND MAINTENANCE MANUALS

- A. Provide Operating and Maintenance Manuals for equipment and materials furnished under this Division.
- B. Submit three final copies of Operating and Maintenance Manuals for review at least ten weeks before the completion date. Assemble data in a completely indexed volume or volumes in three-ring binders and identify the size, model, and features indicated for each item. Print the project name on the outside of the binders.
- C. Maintenance manuals shall include complete cleaning and servicing data compiled in a clear and easily understandable format. Show model numbers of each piece of equipment, complete lists of replacement parts, capacity ratings, and actual loads.
- D. Provide the following information where applicable:
  - 1. Identifying name and mark number
  - 2. Locations (where several similar items are used, provide a list)
  - 3. Complete nameplate data
  - 4. Certified Record Drawings and Final Reviewed submittals
  - 5. Parts list
  - 6. Performance curves and data
  - 7. Wiring diagrams
  - 8. Manufacturer's recommended operating and maintenance instructions with all non-applicable information deleted
  - 9. List of spare parts recommended for normal service requirements
  - 10. Assembly and disassembly instructions with exploded-view drawings where necessary
  - 11. Test reports
  - 12. Trouble shooting diagnostic instructions, where applicable

### 3.21 RECORD DRAWINGS

- A. The Contractor shall maintain on a daily basis at the Project site a complete set of Record Drawings. The Record Drawings shall initially consist of a set of construction drawings or AutoCAD files of the Contractor's Coordination Drawings. The prints shall be marked or the AutoCAD files electronically updated to show the precise location of all buried or concealed work and equipment, including embedded conduit, raceways and boxes, and all changes and

deviations in the Electrical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite written instructions from the Architect or Engineer. The updated Coordination Drawings shall be used to produce the final Record Drawings that shall be delivered to the Owner in AutoCAD electronic format and full-size hard copy format upon Project completion.

- B. Record dimensions clearly and accurately to delineate the work as installed. Suitably identify locations of all equipment by at least two dimensions to permanent structures.
- C. The Contractor and Subcontractor shall mark all in-progress Record Drawings on the front lower right hand corner with a rubber stamp impression or an AutoCAD image similar to the following:

**RECORD DRAWING**  
**(3/8-inch high letters)**

**To be used for recording Field Deviations and  
Dimensional Data Only**  
**(5/16-inch high letters)**

- D. Upon completion of the work, the Contractor and Subcontractor(s) shall certify all Record Drawings on the front lower right hand corner adjacent to the above marking with a rubber stamp impression or an AutoCAD image similar to the following:

**RECORD DRAWING**  
**CERTIFIED CORRECT**  
**(3/8-inch high letters)**

**(Printed Name of General Contractor)**  
**(5/16-inch high letters)**

**Date:** \_\_\_\_\_

**(Printed Name of Subcontractor)**  
**(5/16-inch high letters)**

**Date:** \_\_\_\_\_

- E. Prior to final acceptance of the Work of this Division, the Contractor shall submit properly certified Record Drawings to the Architect and Engineer for review and shall make changes, corrections, or additions as the Architect and/or Engineer may require to the Record Drawings. After the Architect's and Engineer's review, and any required Contractor revisions, the Record Drawings shall be delivered to the Owner on electronic media in AutoCAD format. The Architect and Engineer do not assume any responsibility for the accuracy or completeness of the Record Drawings.

### 3.22 FINAL PUNCHLIST

- A. Prior to the Final Punchlist, certify that systems and equipment are complete, operational, and are in compliance with the Contract Documents.
- B. During the Final Punchlist, provide personnel with access keys, hand held radios, and necessary expertise to operate each system and piece of equipment to demonstrate operational compliance with the Contract Documents.
- C. Any deficiencies noted on the Final Punchlist shall be expeditiously corrected and certified in writing.

END OF SECTION 260500

## SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Connectors, splices, and terminations rated 600 V and less.

#### 1.2 DEFINITIONS

- A. PV: Photovoltaic.
- B. RoHS: Restriction of Hazardous Substances.
- C. VFC: Variable-frequency controller.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.
- C. Qualification Data: For testing agency.
- D. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

## 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. 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."
- C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- D. Conductor Insulation:
  - 1. Type RHH and Type RHW-2: Comply with UL 44.
  - 2. Type THHN and Type THWN-2: Comply with UL 83.
  - 3. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
  - 4. Type XHHW-2: Comply with UL 44.
  - 5. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
    - a. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent braided shields with full size drain wire, full sized insulated ground wire, and sunlight- and oil-resistant outer PVC jacket. Provide this cable between VFCs and motor loads as indicated on drawings.

### 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. 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."
- C. Circuits:
  - 1. Single circuit and multicircuit with color-coded conductors.
- D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- E. Ground Conductor: Insulated.
- F. Conductor Insulation:
  - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
  - 2. Type XHHW-2: Comply with UL 44.
- G. Armor: Steel or lightweight Aluminum, interlocked.
- H. Jacket: PVC applied over armor (when Specified).

## 2.3 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.

## 2.4 INSULATING TAPE

- A. Provide vinyl plastic tape that meets the requirements of UL 510 and has the following characteristics:
  - 1. 8.5 Mil minim thickness.
  - 2. ASTM D-3005 Standard specification for low-temperature resistant vinyl Chloride plastic pressure-sensitive electrical insulating type – type1.
  - 3. Rated 600 volts and 150°C, suitable for indoor and outdoor applications.
  - 4. Retains flexibility, adhesion, and applicable at temperature ranges from 0 through 100°F without loss of physical or electrical properties.



5. Resistant to abrasion, moisture, alkalis, acid, corrosion, and sunlight
6. Tape manufacturer: 3M "Scotch Super 88" or approved equal.

## 2.5 MANUFACTURERS

- A. Wire Manufacturers: subject to compliance with requirements, provide products by one of the following (no exceptions):
  1. Southwire Company
  2. General Cable
  3. The Okonite Company
  4. Belden
  5. VitaLink
  6. Pyrotenax
- B. Connectors Manufacturers: subject to compliance with requirements, provide products by one of the following (no exceptions):
  1. Hubbell
  2. Thomas & Betts
  3. 3M Company

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders/Branch circuits: Copper; solid for No. 10 AWG and No. 12 AWG; stranded for No. 8 AWG and larger.
- B. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway; Type XHHW-2, single conductors in raceway; Type USE, single conductor in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.

- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway; Type XHHW-2, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.
- F. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway;
- H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- I. Branch Circuits Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.
- J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- K. VFC Output Circuits: Type XHHW-2 in metal conduit; Type TC-ER cable with dual tape shield.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Contract drawings do not indicate size of branch circuit wiring; use No.12 AWG as a minimum wire size for branch circuit wiring. For 20 Ampere branch circuits whose length from the panel to the furthest outlet exceeds 100 feet for 120-volt circuits or 150 feet for 277-volt circuits; use No. 10 AWG or larger for the entire branch circuit installation.
- C. A shared neutral may be utilized for circuits other than circuits used for dimmers, ground fault interrupter receptacles or circuit breakers, isolated ground receptacles, and isolated ground surge suppressor type devices
- D. 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.

- E. 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.
- F. Do not install wire in incomplete conduit runs nor until after concrete work and plastering is completed and moisture is swabbed from the conduits. Eliminate splices where possible. Where necessary, splice in readily accessible pull, junction or outlet box.
- G. Take precautions to avoid entrance of dirt and water into the conduit and cuts. Clean conduits and ducts to remove and pulling compound prior to pulling cables. Do not damage conductor insulation, braid jacket or sheath during installation. Any damaged conductors shall be replaced immediately.
- H. Use pulling means, including fish tape, cable, rope, cable reels on jacks, and basket-weave wire/cable grips, that will not damage cables or raceway. Do not exceed maximum recommended pulling tension of wire and cable
- I. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- J. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Except where lugs are furnished with equipment, 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. Circumferential compression type connector (provide for splices and connections No. 6 AWG and larger):
  - 1. Use for incoming and outgoing cable connections at enclosures and for ground connections.
  - 2. Use manufacturer's approved tool and correct size hex head with embossed die number on the connector or lug.
  - 3. Make crimped indentions parallel with insulation putty.
  - 4. Fill voids and irregularities with insulation putty.

5. Cover nearly with four (4) layers of vinyl plastic tape except where insulated covers are permitted; half-lap tape in two (2) directions.

- D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

### 3.5 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.

### 3.6 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."

### 3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to the project specifications.

### 3.8 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.
  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 and conductors feeding the following critical equipment and services for compliance with requirements:
  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/riser 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.
    - i. Insulation resistance to comply with ICEA values.
  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 switches 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 switch 11 months after date of Substantial Completion.
- E. Cables will be considered defective if they do not pass tests and inspections.
- F. 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 260519

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## SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Provide a complete grounding system in accordance with the Contract Documents and as specified herein.

#### 1.2 SUBMITTALS

- A. Minimum 1/8" scale floor plan drawings depicting the building ground electrode system as to be installed.
- B. Detailed riser diagram depicting the building ground electrode system and bonding as to be installed.
- C. Product data sheets (cut sheets) for all ground bus bars and other components of the grounding system.
- D. Field test reports.

#### 1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

### 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 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.



B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

## 2.3 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: 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. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Lay-in Lug Connector: Mechanical type, aluminum or copper rated for direct burial terminal with set screw.

- J. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- K. Straps: Solid copper, cast-bronze clamp or copper lugs. Rated for 600 A.
- L. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.
- M. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- N. Water Pipe Clamps:
  - 1. Mechanical type, two pieces with 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.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.
- B. Ground Plates: 1/4-inch-thick, hot-dip galvanized.

## 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 copper conductor, No. 2/0 AWG minimum.
  - 1. Bury at least 24 inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical 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.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

### 3.2 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.
- B. At utility transformer, ground per utility company requirements and standards.

### 3.3 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. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters

enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

- F. 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.

### 3.4 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 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. 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.
- 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. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. 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.
- E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- F. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated item, extending around the perimeter of building area or item indicated.
1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
  2. Bury ground ring not less than 24 inches from building's foundation.
- G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- 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 test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- 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 Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
  - 4. Substations and Pad-Mounted Equipment: 5 ohms.
  - 5. Manhole Grounds: 10 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 260526

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## SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

#### 1.2 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. Hangers.
  - b. Steel slotted support systems.
  - c. Nonmetallic support systems.
  - d. Trapeze hangers.
  - e. Clamps.
  - f. Turnbuckles.
  - g. Sockets.
  - h. Eye nuts.
  - i. Saddles.
  - j. Brackets.
2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Trapeze hangers. Include product data for components.
2. Steel slotted-channel systems.
3. Nonmetallic slotted-channel systems.
4. Equipment supports.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.



- C. Coordination Drawings: Reflected ceiling plan(s) 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. Suspended ceiling components.
  2. Structural members to which hangers and supports will be attached.
  3. Size and location of initial access modules for acoustical tile.
  4. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Projectors.

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
1. Channel Width: 1-5/8 inches.
  2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
  6. Channel Dimensions: Selected for applicable load criteria.
- B. Aluminum Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
1. Channel Width: 1-5/8 inches.
  2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

4. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
  5. Channel Dimensions: Selected for applicable load criteria.
- C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c., in at least one surface.
1. Channel Width: 1-5/8 inches.
  2. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
  3. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
  4. Rated Strength: Selected to suit applicable load criteria.
  5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- D. Conduit and Cable Support Devices: Steel, Stainless-steel or Glass-fiber-resin hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  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 A 325.
6. Toggle Bolts: Stainless-steel springhead type.
7. Hanger Rods: Threaded steel.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- 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.
- C. 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. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  6. To Light Steel: Sheet metal screws.
  7. 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.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 260529

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## SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.

#### 1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing
- B. FMC: Flexible metal conduit
- C. GRC: Galvanized rigid steel conduit.
- D. MC: Metal Clad Cable
- E. LFMC: Liquid-tight flexible metal conduit
- F. RNC: Rigid nonmetallic conduit

#### 1.3 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Coordination Drawings: 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, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. MC: Comply with UL 1569 and NEC article 330.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - 1. Comply with NEMA RN 1,
  - 2. External PVC Coating Thickness: 0.040 inch, minimum.
  - 3. Internal urethane coating Thickness: 0.002 inch, minimum.
  - 4. Hot dipped galvanized threads
  - 5. PVC Coating shall be of the same manufacturer of the conduit.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. FMC: Comply with UL 1; single strip, continuous, flexible interlocked double-wrapped steel, galvanized inside and outside forming smooth internal wiring channel.
- G. LFMC: Flexible steel conduit with PVC jacket, UV stable, machine tool gray in color, lightweight aluminum core internal construction and complying with UL 360.
- H. Fittings for Metal Conduit Comply with NEMA FB 1 and UL 514:
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
  - 2. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: Set screw.
  - 3. 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.
  - 4. Fittings for PVC-coated Rigid Steel Conduits: Minimum PVC thickness of 0.040 inch, 0.002 inch thickness of internal urethane, overlapping sleeves protecting threaded joints. All conduit bodies shall be NEMA 4x Rated with encapsulated stainless steel screws.

5. Fittings for LFMC: Body, gland and lock nut shall be steel of malleable iron. Ground cone shall be steel, sealing ring and insulator shall be blue molded thermoplastic at 150°C (221°F) maximum.
6. Fittings for GRC: Threaded rigid steel conduit fittings. Comply with NEMA FB 2.10.
- I. Joint Compound for 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, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. RNC: Type EPC-40-PVC for 90°C, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. Materials must have tensile strength of 7,000-7,200 psi at 73.4°F, flexural strength of 12,000 psi and compressive strength of 9,000 psi.
- D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- E. Raceway, fittings, and cement must be produced by the same manufacturer who must have had a minimum of ten (10) years' experience in manufacturing of these products.

## 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. 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.
- B. 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.
- C. Wireway Covers: Hinged cover secured with captive screws unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish NEMA 250 rated.



## 2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- D. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.5 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways:
  - 1. Refer to drawings for location(s), type(s), and quantity(s) of surface metal raceway.
    - a. Surface finish: be satin, anodized #204 type clear, Class R1 mil-Spec with minimum anodized finish of .004" unless otherwise noted.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

## 2.6 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1.

- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. 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.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- J. Gangable boxes are allowed.
- K. Cabinets:
  - 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.
  - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  - 1. Tests of materials shall be performed by an independent testing agency.
  - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

## 2.8 MANUFACTURERS

- A. Raceway and Fitting Manufacturers: subject to compliance with requirements, provide products by one of the following (no exceptions):
1. Wheatland Tube
  2. Allied Tube & Conduit
  3. Thomas & Betts
  4. Hubble
  5. Legrand
  6. Calbond
  7. Western Tube and Conduit
  8. Republic Conduit

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. The following application must be adhered to. Raceways installed that are not conforming to this listing must be removed and replace with specified material at no additional expense.

| Raceway Types                                   | Applications                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Galvanized Rigid Steel Conduit (GRC)            | Where exposed to mechanical injury, where specifically required; indoors where exposed to moisture; where required by codes and for all circuits in excess of 600 volts. Outdoor locations, sump and ejector pits, elevator pits, loading docks, garage, rooftops and gymnasium.                                                       |
| PVC Coated Galvanized Rigid Steel Conduit (GRC) | Where exposed to extreme outdoor and indoor corrosion and or weather conditions: Stub out of Concrete applications. In applications where two (2) UL Listed Layers of Corrosion protection is required and Hot Dipped Galvanized Conduit as Primary Protection is listed PVC Coating is listed as Primary Corrosion is also UL Listed. |
| Electrical Metallic tubing                      | Use in every instance except where another                                                                                                                                                                                                                                                                                             |

| Raceway Types                       | Applications                                                                                                                                                                                                                                          |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (EMT)                               | material is not specified.                                                                                                                                                                                                                            |
| Metal Clad Cable (MC)               | Lighting and receptacle branch circuits concealed in dry hollow spaces of a building. May not be used in areas where it would be subjected to physical damage, or where prohibited by Code.                                                           |
| Flexible Metal Conduit              | Use in dry areas for connections to lighting fixtures in hung ceilings, connections to equipment installed in removable panels of hung ceilings; at all transformer or equipment raceway connections where sound and vibration isolation is required. |
| Liquid-Tight Flexible Metal Conduit | Use in areas subject to moisture where flexible metal conduit is unacceptable, at connections to all motors, and all raised floor areas.                                                                                                              |
| Rigid Non-Metallic Conduit          | Schedule 40 - Where raceways are in a slab below grade levels; for raceway duct banks. Schedule 80 - For underground raceways outside of the building which are not encased in concrete.                                                              |
| Wireways and Auxiliary Gutters      | Where indicated on the Contract Documents and as otherwise specifically required.                                                                                                                                                                     |
| Boxes and Enclosures                | NEMA 250, Type 1, except use NEMA 250, Type 4 in kitchens and damp/or wet locations. Outdoors use NEMA 250, Type 3R.                                                                                                                                  |

- B. Provide separate raceways for all wiring systems, including security, data, paging, low voltage et al. All 480Y/277-volt wiring must be kept independent of 208Y/120 volt wiring. Emergency system wiring must be kept independent of the normal system wiring. Provide grounding conductor within all circuits. Minimum size 3/4-inch for home runs and 1-inch minimum for power distribution. Wiring of each type and system must be installed in separate raceways.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid Galvanized Steel Conduit (GRC): Use threaded rigid steel conduit fittings. Comply with NEMA FB 2.10.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  3. EMT: Use setscrew steel fittings. Comply with NEMA FB 2.10.
  4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- E. Install surface raceways only where indicated on Drawings.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. 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.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Provide one (1) empty 3/4 inch raceway for each three (3) spare unused poles or spaces of each flush-mounted panelboard. Terminate empty 3/4 inch conduits in a junction

box, which after completion is accessible to facilitate future branch circuit extension. Provide pull lines in each raceway.

- J. Raceways in hung ceilings shall be installed on and secured to the slab or primary structural members of the ceiling, not to lathing channels or T-bars, Z-bars or other elements which are direct supports of the ceiling panels. Secure conduit firmly to the steel with clips and fittings designed for that purpose. Install as high as possible but not less than 1'-0" above the hung ceilings.
- K. Raceways Embedded in Slabs:
  - 1. Install no raceway in the concrete slab except with the permission of the Structural Engineer and written consent of the Owner.
  - 2. Do not install raceways larger than 1-1/4 inch size in structural concrete slabs.
  - 3. In no case will the installation of raceways be permitted to interfere with proper placement of principal reinforcement.
  - 4. Place raceways in the structural slabs between the upper and lower layers of reinforcing steel. Careful bending of the conduits is required.
  - 5. Space the raceways embedded in concrete slabs not less than eight (8) inches on centers and as widely spaced as possible where they converge at panels or junction boxes.
  - 6. Install raceways running parallel to slabs supports, such as beams, columns and structural walls, not less than 12 inches from such supporting elements.
  - 7. Secure saddle supports for conduit, outlet boxes, junction boxes, inserts, etc. with suitable adhesives during concrete pour of the slab to prevent displacement.
  - 8. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
- 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. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

- P. 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.
- Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- R. 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.
- S. 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.
- T. 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.
- U. Surface Raceways:
  - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
  - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- V. 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.
- W. 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 conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where an underground service raceway enters a building or structure.
  - 3. Where otherwise required by NFPA 70.
- X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Y. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
  - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
  - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
  - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches 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 subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

AA. OUTLET, JUNCTION, AND PULL BOXES

1. Provide outlet, junction, and pull boxes as indicated on the Contract Documents and as required for the complete installation of the various electrical systems, and to facilitate proper pulling of the cables. Size the junction boxes and pull boxes per the NEC. Size the boxes on any empty conduit systems as if containing conductors of No.4 AWG.



2. The exact location of outlets and equipment is governed by the structural conditions and obstructions, or other equipment items. When necessary, relocate outlets so that when fixtures or equipment are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment. Verify final location of outlets, panels equipment, etc., with the Architect prior to installation.
3. Back-to-back outlets in the same wall, or "thru-wall" type boxes are not permitted. Provide 12-inch minimum spacing for outlets shown on opposite sides of a common wall to minimize sound transmission.
4. Fit outlet boxes in finished ceilings or walls with appropriate covers, set flush with the finished surface. Where more than one (1) switch or device is located at one (1) point, use gang boxes and covers unless otherwise indicated. Sectional switch boxes or utility boxes are not permitted. Provide tile box or 4 inch square box with tile ring in masonry walls not plastered or furred. Where drywall material is utilized, provide plaster ring. Provide outlet boxes of type and size suitable for the specific application. Where outlet boxes contain two (2) or more 277 volt devices, or where devices occur of different applied voltages, or where normal and emergency devices occur in the same box, provide suitable barrier(s).
5. All outlet and device box depths shall have sufficient depth to prevent damage to the conductors when devices or utilization equipment are installed as intended in the box.
6. Types of Boxes and Fittings for Various Locations:

| Location                               | Type                                                             |
|----------------------------------------|------------------------------------------------------------------|
| Outlet                                 | Galvanized pressed steel                                         |
| Outlet exposed to moisture or outdoors | Cast type conduit fitting                                        |
| Splice                                 | Galvanized pressed steel                                         |
| Splice exposed to moisture or outdoors | Cast type conduit fitting or sheet metal (4½" x 5" x 3" minimum) |
| Pull or Junction                       | Cast type conduit fitting or sheet metal (4½" x 5" x 3" minimum) |
| Pull or Junction - Outdoors            | Aluminum (4½" x 5" x 3" minimum)                                 |
| Terminal                               | Sheet steel (6" x 6" x 3" minimum)                               |
| Terminal - Outdoors                    | Aluminum (6" x 6" x 3" minimum)                                  |

BB. PULL BOX SPACING

1. Provide pull boxes so no individual conduit run contains more than the equivalent of four (4) quarter bends (360° total).
2. Conduit Sizes 1¼" and Larger:
  - a. Provide boxes to prevent cable from being excessively twisted, stretched or flexed during installation.
  - b. Provide boxes so that maximum pulling tensions do not exceed the cable manufacturer's recommendations.
  - c. Provide support racks for boxes with multiple sets of conductors so that the conductors do not rest on any metal work inside the box.
3. Conduit Sizes 1 inch and Smaller, provide boxes at every (Maximum Distances):

| Distance | Run Type                                                 |
|----------|----------------------------------------------------------|
| 150 feet | straight runs                                            |
| 100 feet | runs with one (1) 90° bend or equivalent                 |
| 75 feet  | runs with two (2) 90° bends or equivalent                |
| 50 feet  | runs with three (3) or (4) four 90° bends or equivalent. |

- CC. 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.
- DD. 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.
- EE. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- FF. Locate boxes so that cover or plate will not span different building finishes.
- GG. 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.
- HH. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- II. Set metal floor boxes level and flush with finished floor surface.

- JJ. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

#### A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified elsewhere in the project specifications for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified elsewhere in the project specifications.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified elsewhere in the project specifications.
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
  - a. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

### 3.4 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."

### 3.5 FIRESTOPPING

- A. Install firestopping at penetrations of all fire-rated floor and wall assemblies, per the project specifications.

### 3.6 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

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## SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

#### 1.2 SUBMITTALS

A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
  - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
  - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.3 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, 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 Sealants: Single-component, silicone-based, 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.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. 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 annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 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 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.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.



- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- 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.

### 3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

## SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

#### 1.2 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. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

C. 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 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.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- B. 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.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 240-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
  - 4. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  - 5. Color for Neutral: White.
  - 6. Color for Equipment Grounds: Green.
  - 7. Colors for Isolated Grounds: Green with white stripe.
- C. Warning Label Colors:
  - 1. Identify system voltage with black letters on an orange background.

- D. Warning labels and signs shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## 2.3 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.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.
  - 1. 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.
  - 2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. 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. 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 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

## 2.5 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.
- 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.
- C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
- E. Underground-Line Warning Tape:
  - 1. Tape:
    - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications 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.
  - 2. 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".
    - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.6 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- B. 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.

C. Write-on Tags:

1. Polyester Tags: 0.010-inch-thick, with corrosion-resistant grommet and cable tie for attachment.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:
  - a. For signs up to 20 sq. in., minimum 1/16 inch.
  - 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.
  - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

A. 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 D 638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 deg F.
  4. Color: Black, except where used for color-coding.
- B. 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 D 638: 12,000 psi.
  3. Temperature Range: Minus 40 to plus 185 deg F.
  4. Color: Black.
- C. 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 D 638: 7000 psi.
  3. UL 94 Flame Rating: 94V-0.
  4. Temperature Range: Minus 50 to plus 284 deg F.
  5. Color: Black.

## 2.9 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. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- K. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "EMERGENCY POWER."
  - 2. "POWER."
  - 3. "UPS."
- L. 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.
- M. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.



- N. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. 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.
- P. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- Q. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- R. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- S. 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.
- T. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- U. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- V. 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 or concrete envelope exceeds 16 inches overall.
  - 2. Limit use of underground-line warning tape to direct-buried cables.
- W. Metal Tags:
  - 1. Place in a location with high visibility and accessibility.
- X. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.

Y. Baked-Enamel 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 minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.

Z. Metal-Backed Butyrate 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.

AA. 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.

BB. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

END OF SECTION 260553

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## SECTION 262726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Straight-blade convenience, isolated-ground, and tamper-resistant receptacles.
2. GFCI receptacles.
3. Toggle switches.
4. Wall-box dimmers.
5. Wall plates.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: One for each type of device and wall plate specified, in each color specified.

### 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 application.
- B. Comply with NFPA 70.
- C. Devices for Owner-Furnished Equipment:
1. Receptacles: Match plug configurations.
  2. Cord and Plug Sets: Match equipment requirements.
- D. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

#### 2.2 STRAIGHT-BLADE RECEPTACLES

- A. Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

- B. Isolated-Ground, Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

- 1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

- C. Tamper-Resistant Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

## 2.3 GFCI RECEPTACLES

- A. General Description:

- 1. 125 V, 20 A, straight blade, feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

## 2.4 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

- B. Switches, 120/277 V, 20 A:

- C. Pilot-Light Switches: 120/277 V, 20 A.

- 1. Description: Single pole, with LED-lighted handle, illuminated when switch is off.

- D. Key-Operated Switches: 120/277 V, 20 A.

- 1. Description: Single pole, with factory-supplied key in lieu of switch handle.

- E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

- F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

## 2.5 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider or toggle switch; with single-pole or three-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.
- D. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

## 2.6 WALL PLATES

- A. 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: As selected by the Architect.
  - 3. Material for Unfinished Spaces: Galvanized steel.
  - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

## 2.7 FINISHES

- A. 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.
  - 2. Wiring Devices Connected to Emergency Power System: Red.
  - 3. SPD Devices: Blue.
  - 4. Isolated-Ground Receptacles: Orange.
- B. Wall Plate Color: As selected by the Architect.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

| TYPICAL MOUNTING HEIGHTS                       |                                                                                                                             |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| DEVICE                                         | MOUNTING HEIGHT                                                                                                             |
| Wall switches, card readers                    | 48 inches above finished floor to center                                                                                    |
| Receptacle outlets, data outlets, CATV outlets | 18 inches above finished floor to center                                                                                    |
| Receptacle outlets – above counter             | 42 inches above finished floor to center, or 8 inches to center above countertops                                           |
| Wall telephone outlets                         | 48 inches above finished floor to center                                                                                    |
| Clock outlets                                  | 96 inches above finished floor to center, or 6 inches below ceiling.<br>Above doors, centered between door trim and ceiling |

- 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 meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
  - a. Cut back and pigtail or replace all damaged conductors.

- b. Straighten conductors that remain and remove corrosion and foreign matter.
- c. 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. Dimmers:

- 1. Install dimmers within terms of their listing.
- 2. Verify that dimmers used for fan-speed control are listed for that application.
- 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.



- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 IDENTIFICATION

- A. 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.

### 3.4 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Tests for Convenience Receptacles:
  1. Line Voltage: Acceptable range is 105 to 132 V.
  2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is 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.
- D. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 262726

## SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

#### 1.2 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. Provide in PDF electronic format.

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.

#### 1.3 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

#### 1.4 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.

#### 1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

### 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. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

#### 2.2 NONFUSIBLE SWITCHES

- A. Manufacturer shall be the same as the switchboards and panelboards.
- B. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

- C. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 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.
- D. 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.
  - 5. Service-Rated Switches: Labeled for use as service equipment.

## 2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturer shall be the same as the switchboards and panelboards.
- 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. Lugs shall be suitable for 194 deg F rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.
- G. Standards: Comply with UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents.

- H. 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.
- I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long- and short-time time adjustments.
  - 4. Ground-fault pickup level, time delay, and I-squared t response.
- K. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- L. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- M. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- N. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- O. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical or Compression type, suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
  - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 5. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system.
  - 6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
8. Alarm Switch: One NO/NC contact that operates only when circuit breaker has tripped.
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
10. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
11. Electrical Operator: Provide remote control for on, off, and reset operations.

## 2.4 MOLDED-CASE SWITCHES

- A. Manufacturer shall be the same as the switchboards and panelboards.
- B. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Features and Accessories:
  1. Standard frame sizes and number of poles.
  2. Lugs:
    - a. Mechanical or Compression type, suitable for number, size, trip ratings, and conductor material.
    - b. Lugs shall be suitable for 194 deg F rated wire, sized according to the 167 deg F temperature rating in NFPA 70.
  3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and 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.
  4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  6. Alarm Switch: One NO/NC contact that operates only when switch has tripped.
  7. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
  8. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
  9. Electrical Operator: Provide remote control for on, off, and reset operations.

## 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 finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) gray baked enamel paint, or electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.
- E. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

### 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 Owner no fewer than five business 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 Owner'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 3.
  - 3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
  - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
  - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

### 3.4 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain code required workspace clearances and required clearances for equipment access doors and panels, regardless of location indicated on the drawings.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NFPA 70 and NECA 1.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in the Electrical Power System Study, required per specification section 260573 and furnished by the Electrical Contractor.

END OF SECTION 262816



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## SECTION 265219 - EMERGENCY AND EXIT LIGHTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Emergency lighting units.
  - 2. Exit signs.
  - 3. Luminaire supports.

#### 1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.3 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. Battery and charger for light units.
  - 4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
  - 5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.
    - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule:
  - 1. For emergency lighting units. Use same designations indicated on Drawings.
  - 2. For exit signs. Use same designations indicated on Drawings.

#### 1.4 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### 1.6 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. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

### PART 2 - PRODUCTS

#### 2.1 PRODUCTS

- A. Refer to Lighting Fixture Schedule on the drawings for the specified fixtures and options.

## 2.2 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 emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for fluorescent luminaires.
- F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.
- G. Bulb Shape: Complying with ANSI C79.1.
- H. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.
  - 1. Emergency Connection: Operate lamp(s) continuously full lumen output upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
  - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  - 3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
    - b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
    - c. Humidity: More than 95 percent (condensing).
    - d. Altitude: Exceeding 3300 feet.
  - 4. Nightlight Connection: Operate lamp continuously at 40 percent of rated light output.
  - 5. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
    - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

- b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
  - 6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
  - 7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
- I. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.
- 1. Emergency Connection: Operate LED lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire.
  - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  - 3. Nightlight Connection: Operate lamp in a remote luminaire continuously.
  - 4. Charger: Fully automatic, solid-state, constant-current type.
  - 5. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the ballast or emergency power unit manufacturer, whichever is less.
  - 6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  - 7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
  - 8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

## 2.3 EMERGENCY LIGHTING

- A. General Requirements for Emergency Lighting Units: Self-contained units.
- B. Emergency Luminaires: as indicated on the drawings.
- C. Emergency Lighting Unit: as indicated on the drawings.
- D. Remote Emergency Lighting Units: as indicated on the drawings.

## 2.4 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 1. Lamps for AC Operation: LED; 50,000 hours minimum rated lamp life.
  - 2. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

## 2.5 MATERIALS

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access:
  - 1. Smooth operating, free of light leakage under operating conditions.
  - 2. Designed to permit relamping without use of tools.
  - 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Housings:
  - 1. As indicated on the drawings.
- D. Conduit: Electrical metallic tubing, minimum 3/4 inch in diameter.

## 2.6 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, 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 and emergency power unit weight.
  - 2. Able to maintain luminaire position when testing emergency power unit.
  - 3. Provide support for luminaire and emergency power unit 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. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. 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.

### 3.4 STARTUP SERVICE

- A. Perform startup service:
  - 1. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

### 3.5 ADJUSTING

- A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:
  - 1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.
    - a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 265219



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## SECTION 283100 – FIRE DETECTION AND ALARM

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes:
  - 1. Notification appliances.

#### 1.2 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product, including finished options and accessories.
  - 1. Include construction details, material descriptions, dimensions, profiles and finishes.
  - 2. Include rated capacities, operating characteristics, and electrical characteristics.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire alarm Level III technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- D. Manufacturer and equipment supplier shall have a minimum of ten years' prior experience in New York State. Equipment supplier shall have 24-hour parts and labor service available with a maximum 4-hour response time. There shall be a minimum of 2 Independent Authorized Distributors within a 50 mile radius of project. Proprietary equipment shall not be acceptable.

## 1.5 PROJECT CONDITIONS

- A. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
- B. Warranty Period: Three years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. The existing fire alarm system is Siemens. All new fire detection and alarm system components shall be of the same manufacturer and must meet all requirements of the contract documents.
- B. Existing Fire Alarm Vendor Contact Info:  
  
Owen Grant  
Falcon Engineered Security Solutions, Inc.  
(917) 662-2042  
(718) 618-7160
- C. Products for this project shall be of the latest design that has been in service for at least two (2) years, and no more than 4 years. Obsolete or discontinued models are not acceptable.

### 2.2 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
  - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1 inch high letters on the lens.
  - 1. Rated Light Output:
    - a. 15/30/75/110 cd, selectable in the field.
  - 2. Mounting: Wall mounted unless otherwise indicated.
  - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  - 4. Flashing shall be in a temporal pattern, synchronized with other units.
  - 5. Strobe Leads: Factory connected to screw terminals.
  - 6. Mounting Faceplate: Factory finished, red.

## 2.3 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the device requiring protection.
  - 1. Factory fabricated and furnished by device manufacturer.
  - 2. Finish: Paint of color to match the protected device.
  - 3. Guards must be UL cross listed with devices being used.

## 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 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire alarm equipment. Install all 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 all other trades have completed cleanup shall be replaced.
  - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
- C. Audible Alarm Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- D. Visible Alarm-Indicating Devices: Install adjacent to each alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- E. Device Location-Indicating Lights: Locate in public space near the device they monitor.

### 3.3 PATHWAYS

- A. Fire alarm pathway and circuit wiring installation shall comply with NEC Article 760.
- B. Where exposed, all fire alarm circuits shall be installed in dedicated EMT conduit.
- C. Pathways above recessed ceilings and in nonaccessible locations may be plenum-rated cable.
- D. All pathways must be independently supported from the structure above.
- E. Where passing through a wall or floor, provide a metal raceway or rigid nonmetallic conduit sleeve.
- F. All penetrations of rated walls and floors shall be properly fire-stopped.

### 3.4 IDENTIFICATION

- A. Provide an identification nameplate for each equipment cabinet. Nameplates shall correspond with labeling identified in the submittal drawings.
- B. Fire alarm conduit shall be permanently labeled "FIRE ALARM" every 30 feet.
- C. Fire alarm junction boxes shall be painted red.
- D. All initiating and indicating devices shall be labeled with self-adhesive tape with black lettering and identification labeling according to circuit loop and device address/number.
- E. Color code all wiring per recommended standards. Tag all wires in terminal cabinets with tie wrap tags with inked identification.
- F. Install framed instructions in a location visible from FACP.

### 3.5 GROUNDING

- A. Ground FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to FACP.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

### 3.6 TESTING

- A. The fire alarm system manufacturer or manufacturer's authorized representative shall test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests shall be witnessed by District (Owner), Engineer of Record, and the Fire Department.
- C. The following tests and inspections shall be performed:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72.
    - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
  4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
  5. System manufacturer shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify the 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.

END OF SECTION 283100

## SECTION 312000 - EARTH MOVING

### PART 1 - GENERAL

#### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Cast-In-Place Concrete: Section 033000

#### 1.02 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
  - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- F. Fill: Soil materials used to raise existing grades.
- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- I. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.



### 1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
  - 1. Classification according to ASTM D2487.
  - 2. Laboratory compaction curve according to ASTM D698.

### 1.04 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

### 1.05 PROJECT CONDITIONS

- A. Utility Location: Existing utilities which are to remain must be maintained and protected during earth moving operations.
- B. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Foot traffic.
  - 3. Excavation or other digging unless otherwise indicated.
- C. Do not direct vehicle or equipment exhaust towards protection zones.
- D. Prohibit heat sources, flames, ignition sources and smoking within or near protection zones.

## PART 2 - PRODUCTS

### 2.01 SOIL MATERIALS

- A. General: Provide borrow soil when sufficient satisfactory soil materials are not available from excavations.
- B. Terms, descriptions, and gradations of granular soil materials in remaining paragraphs are examples only. Revise to comply with local practices and to suit Project. For example, granular materials may be referenced by state or local highway designations rather than by ASTM classifications.

- C. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

#### 3.02 DEWATERING

- A. Provide dewatering system of sufficient scope, size and capacity to control hydrostatic pressures and to lower, control, remove and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. Protect subgrades and foundation soils from softening, washout and damage by rain or water accumulation.

#### 3.03 EXPLOSIVES

- A. Explosives: Do not use explosives.

### 3.04 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

### 3.05 SUBGRADE INSPECTION

- A. Notify Owner's Representative when excavations have reached required subgrade.
- B. If Owner's Representative determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

### 3.06 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with a 28-day compressive strength of 2500 psi may be used when approved by the Owner's Representative.

### 3.07 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

### 3.08 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
  - 1. Under structures, building slabs, steps and pavements, scarify and recompact top 12-inches of existing subgrade and each layer of backfill or fill soil material a 95 percent.

### 3.09 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
  - 2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
  - 3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
  - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- C. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### 3.11 PROTECTION

- A. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- B. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.12 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
  - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

## SECTION 31 25 13 – EROSION AND SEDIMENT CONTROLS

### PART 1 GENERAL

#### 1.1 SUMMARY

A. This Section includes:

1. Furnish, install, inspect, maintain, and remove soil erosion and sediment control measures during construction as shown on the Contract Documents prepared for this project.
2. Minimize the potential short-term adverse environmental impacts associated with construction activity in environmentally sensitive areas.
3. Assure the quantity and quality of stormwater runoff is not substantially altered due to construction activities.
4. Stabilize slopes and protect offsite areas by the installation and maintenance of stabilization and erosion control measures.
5. Dewatering operation procedure.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 31 20 00: Excavation and Fill

#### 1.3 REFERENCE STANDARDS

- A. New York Standards and Specifications for Erosion and Sediment Control, NYSDEC, latest edition.
- B. NYSDEC: Reducing the Impacts of Stormwater Runoff for New Development, latest edition.
- C. NYSDEC Environmental Conservation Law, Article 17. Titles 7, 8 and Article 70.
- D. 6 NYCRR Parts 611 – 613 and all additions.
- E. OSHA 40 CFR Part 258 and all additions. New York State: Standards and Specifications for Erosion and Sediment Control, latest edition.

#### 1.4 PROJECT CONDITIONS

- A. During construction conduct operations in such a manner as to prevent or reduce to a minimum any damage to any water body from pollution by debris, sediment, chemical or other foreign material, or from the

manipulation of equipment and/or materials in or near a stream or ditch flowing directly to a stream. Any water which has been used for wash purposes or other similar operations which become polluted with sewage, silt, cement, concentrated chlorine, oil, fuels, lubricants, bitumens, or other impurities shall not be discharged into any water body.

- B. In the event of conflict between these specifications and the regulation of other Federal, State, or local jurisdictions, the more restrictive regulations shall apply.
- C. The Work shall consist of furnishing, installing, inspecting, maintaining, and removing soil and erosion control measures as shown on the contract documents or as ordered by the Director's Representative during the life of the contract to provide erosion and sediment control.
- D. Temporary structural measures provide erosion control protection to a critical area for an interim period. A critical area is any disturbed, denuded slope subject to erosion. These are used during construction to prevent offsite sedimentation. Temporary structural measures shall include check dams, construction road stabilization, stabilized construction entrance, dust control, earth dike, level spreader, perimeter dike/swale, pipe slope drain, portable sediment tank, rock dam, sediment basin, sediment traps, silt fence, storm drain inlet protection, straw/hay bale dike, access waterway crossing, storm drain diversion, temporary swale, turbidity curtain, water bars or other erosion control devices or methods as required.
- E. Permanent structural measures also control protection to a critical area. They are used to convey runoff to a safe outlet. They remain in place and continue to function after completion of construction. Permanent structural measures shall include debris basins, diversion, grade stabilization structure, land grading, lined waterway (rock), paved channel, paved flume, retaining wall, riprap, rock outlets, and stream bank protection or other erosion control devices or methods as required.
- F. Vegetative measures shall include brush matting, dune stabilization, grassed waterway, vegetating waterway, mulching, protecting vegetation, seeding, sod, straw/hay bale dike, stream bank protection, temporary swale, topsoil, and vegetating waterways.
- G. Biotechnical measures shall include wattling (live fascines, brush matting, brush layering, live cribwall, and branchpacking) vegetated rock gabions, live staking, tree revetment, and fiber rolls.

## 1.5 DEFINITIONS

- A. Stabilized Construction Entrance: A stabilized pad of aggregate underlain with geo-textile where traffic enters a construction site to reduce or eliminate tracking of sediment to public roads.

- B. Dust Control: Prevent surface and air movement of dust from disturbed soil surfaces.
- C. Portable Sediment Tank: A compartmented tank to which sediment laden water is pumped to retain sediment before pumping the water to adjoining drainage ways.
- D. Sediment Basin: A barrier constructed across a drainage way to intercept and trap sediment.
- E. Sediment Traps: A control device formed by excavation to retain sediment at a storm inlet or other points of collection.
- F. Silt Fence: A barrier of geo-textile fabric installed on contours across the slope to intercept runoff by reducing velocity. Replace after 1 year.
- G. Storm Drain Inlet Protection: A semi-permeable barrier installed around storm inlets to prevent sediment from entering a storm drainage system.
- H. Straw/Hay Bale Dike: Intercept sediment laden runoff by reducing velocity. Replace after 3 months.
- I. Storm drain Diversion: The redirection of a storm drain line or outfall channel for discharge into a sediment trapping device.
- J. Temporary Swale: A temporary excavated drainage swale.
- K. Protecting Vegetation: Protecting trees, shrubs, ground cover and other vegetation from damage.
- L. Temporary Seeding: Erosion control protection to a critical area for an interim period. A critical area is any disturbed, denuded slope subject to erosion.
- M. Permanent Seeding: Grasses established and combined with shrubs to provide perennial vegetative cover on disturbed, denuded, slopes subject to erosion.
- N. Sod: Used where a quick vegetative cover is required.

## 1.6 SUBMITTALS

- A. Product Data: Manufacturer's catalog cuts, specifications and installation instructions.
- B. Contingency Action Plan for prompt remedial action in the event spillage of petroleum products or other pollutants should occur. Contingency Action Plan shall be submitted to the Engineer for acceptance prior to the start of construction.
- C. Name and location of all material suppliers.
- D. Certificate of compliance with the standards specified above for each source of each material.
- E. List of disposal sites for waste and unsuitable materials and all required permits for use of those sites.



- F. Where a Stormwater Pollution Prevention Plan has been prepared, the Engineer shall file a Notice of Intent (NOI) with NYSDEC prior to commencing construction activities and a Notice of Termination (NOT) with NYSDEC following construction.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Silt Fence
  - 1. Mirafi, Envirofence 365 South Holland Drive, Pendergrass, Ga, 30567, (888) 795-0808, <http://www.tencategeo.us/en-us/>
  - 2. Filter X
  - 3. Stabilinka T140N
  - 4. Approved equivalent
- B. Filter fabric inlet protection
- C. Stone and block inlet protection
- D. Temporary filters for inlet protection
- E. Hardwood staking material
- F. Stone material
- G. Dry Rip Rap
  - 1. NYSDOT Standard Specification Section 620

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Prior to any construction activities, install temporary erosion and sediment control barriers or measures as indicated on the Contract Drawings, per manufacturer's specifications
- B. Where a Stormwater Pollution Prevention Plan has been prepared, the Contractor shall comply with all provisions of the "Stormwater Pollution Prevention Plan", prepared by Passero Associates
- C. The Contractor shall be required to protect and preserve existing trees and shrubs in areas designated on the Contract Drawings. Contractor shall replace any tree or shrubs damaged in kind to the satisfaction of the Owner.
- D. The Contractor shall contact the Engineer once the erosion and sediment control structures have been installed.
- E. Prior to commencement of construction, the Engineer shall conduct an assessment of the site and certify that the appropriate erosion and sediment control structures as shown on the Contract Drawings have been adequately installed and implemented.

- F. Staging of Earthwork Activities: All earthwork shall be scheduled so that the smallest possible areas will be unprotected from erosion for the shortest time feasible.
- G. Vegetation adjacent to or outside of access roads or rights-of-way shall not be damaged.
- H. The Engineer has the authority to limit the surface area of erodible earth exposed by earthwork operations and to direct the Contractor to provide immediate temporary or permanent erosion measures to minimize damage to property and contamination of watercourses and water impoundments. Under no circumstances will the area of erodible earth material exposed at one time exceed 5 acres. The Engineer may increase or decrease this area of erodible earth material exposed at one time as determined by their analysis of project, weather and other conditions. The Engineer may limit the area of clearing and grubbing and earthwork operations in progress commensurate with the Contractor's demonstrated capability in protecting erodible earth surfaces with temporary, permanent, vegetative or biotechnical erosion control measures.
- I. Schedule the work so as to minimize the time that earth areas will be exposed to erosive conditions. Provide temporary structural measures immediately to prevent any soil erosion.
- J. Provide temporary seeding on disturbed earth or soil stockpiles exposed for more than 7 days or for any temporary shutdown of construction. In spring, summer or early fall apply rye grass at a rate of 1 lb/ 1000 sq.ft. In late fall or early spring, apply certified Aroostook Rye at a rate of 2.5 lbs./ 1000 sq. ft. Apply hay or straw at a rate of 2 bales/ 1000 sq. ft. or wood fiber hydromulch at the manufacturer's recommended rate. Hay or straw shall be anchored.
- K. Provide temporary grading to facilitate dewatering and control of surface water.
- L. Coordinate the use of permanent controls or finish materials shown with the temporary erosion measures.
- M. After final stabilization has been achieved, temporary sediment and erosion controls must be removed. Areas disturbed during removal must be stabilized immediately.
- N. Disposal of spoil material shall not be in any flood plain, wetland, stream, brook, or sensitive environmental area. The Contractor shall dispose of

spoils within staging areas and provide sediment control barriers accordingly.

### 3.2 CLEARING

- A. Tree trunks and roots, vegetation, and project debris shall not be buried on site.
- B. Staging areas (for storage of materials and stockpiles) shall be located as shown on the plans. Where areas must be cleared for staging area temporary structures, provisions shall be made for regulating drainage and controlling erosion.
- C. All abandoned or useless objects including equipment, supplies, personal property, rubbish, (including those present prior to construction activities) should be removed from the project work area and properly disposed of in accordance with local, state, and federal regulations.

### 3.3 IMPLEMENTATION

- A. All erosion and sediment control devices must be maintained in working order until the site is stabilized. All preventative and remedial maintenance work, including clean out, repair, replacement, re-grading, re-seeding, or re-mulching, must be performed immediately.
- B. The Contractor shall, at the direction of the Engineer, use necessary methods to minimize erosion within access roads, especially in areas that drain to watercourse areas.
- C. Cuts, fills, and other disturbed areas will be maintained to prevent erosion until adequate vegetative/impervious cover is established.
- D. Water, resulting from dewatering operations that will reduce the quality of receiving waters shall not be directly discharged. The Contractor shall provide, install, and maintain sump pits where necessary to dewater operations as detailed on the plans. Stone used within the sump pits shall be washed clean stone. The Contractor shall provide, install and maintain dewatering bags, as deemed necessary to control sediment deposits at critical environmental areas. Lifting straps shall be placed under the unit to facilitate removal after use. Dewatering bags shall be placed on stabilized areas over grass. Discharge hose from pump shall be inserted a minimum of six inches and tightly secured with attached strap to prevent water from flowing out of the unit without being filtered. Water from dewatering operations shall be treated to eliminate the discharge of

sediment and other pollutants to streams and watercourses. The unit shall be replaced when it is half full of sediment or when the sediment has reduced the flow rate of the pump discharge to an impractical rate. Remove and dispose of sediment and dewatering bag off-site.

- E. Silt fence, where identified on plans, shall be installed at down gradient locations to control sediment deposits off-site at critical environmental areas. The silt fence shall be staked (unless noted otherwise), anchored and set as per manufactures specifications. The silt fence shall be inspected on a daily basis and after a rain fall event and repaired as necessary.
- F. A stabilized construction entrance shall be installed and maintained for vehicular access on and off site. The entrance shall be constructed of 2" stone, or approved equal, and shall have a minimum length of 50 feet. The condition of the entrance shall be inspected daily and repaired as necessary.
- G. Dust control shall be controlled by the use of water, or calcium chloride application. Water application shall be applied at a rate where mud is not produced. The rate of application of the calcium chloride shall not exceed Federal, State and Local application rates or manufactures recommendations. Dust control shall be applied on adjacent public streets.
- H. Dry rip-rap shall conform to the lines, grades and thicknesses indicated on construction plans. It shall be a well-graded mass of variable size stones with no areas of uniform size material. Align stones to obtain a close fit and to minimize voids. Fill spaces between stones with spalls of suitable size.
- I. Paved areas within access corridors and parking areas shall be swept on a regular basis (minimum twice per week) as needed to minimize sediment and dust tracked from the work area. Should sediment and dust be tracked off-site, Contractor shall be responsible for sweeping public streets.
- J. During the final site restoration, the Contractor shall remove all sediment and debris deposited in the temporary and permanent erosion and sediment control barriers or measures including but not limited to all culverts and drainage swales, at no additional cost to the Owner.
- K. When all disturbed areas are stable, all temporary erosion and sediment control measures shall be removed per the approval of the Engineer. The

measures are temporary and shall be removed and the areas restored to its original condition when they are no longer required, at no additional cost to the Owner.

- L. The Contractor is fully responsible for maintaining, repairing, and protecting his work throughout the project, at no additional cost to the Owner, until the Owner accepts the work.

END OF SECTION 31 25 13

## SECTION 33 41 00 – STORM UTILITY DRAINAGE PIPING

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Under this section the Contractor shall provide all labor, equipment and material necessary to furnish, install and test all storm utility drainage pipe and fittings as shown on the Contract Drawings.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- B. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Section 31 20 00: Excavation and Fill
- D. Section 33 49 00: Storm Drainage Structures

#### 1.3 PROJECT CONDITIONS

- A. Location of Sewers and Sewer Structures: The location, elevation, and grades of sewers and sewer structures are shown on the Contract Drawings and shall be adhered to as closely as possible. If during construction of the project, it becomes necessary to make changes in the location or grades of the sewers, the Engineer will issue appropriate directions after being contacted by the Contractor.
- B. Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that storm sewerage system piping may be installed in compliance with original design and referenced standards.

#### 1.4 SUBMITTALS

- A. Shop Drawing: Pipes and associated fittings.
- B. Product Data: Manufacturer's specifications, including dimensions, allowable height of cover information, and installation instructions.
- C. Manufacturer's product literature, installation instructions and shop drawings for infiltration systems.
- D. As-built record drawings at project closeout of installed storm sewerage piping and products. An as-built survey prepared by licensed NYS Surveyor depicting the installed storm sewer piping and structures including rim and invert elevations of structures pipe size, pipe type, and invert of all piping. Both hard copy and electronic copy shall be provided to the Owner and Engineer.

#### 1.5 QUALITY ASSURANCE

- A. Comply with standards of the Chain Link Fence Manufacturer's Institute.
  - B. Provide steel fence and related gates as a complete compatible system including necessary erection accessories, fittings, and fastenings.
  - C. Posts and rails shall be continuous without splices.
- 1.6 DELIVERY, STORAGE AND HANDLING
- A. Deliver, store, protect and handle products to site under provisions of the General Conditions.
  - B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
  - C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- 1.7 SEQUENCING AND SCHEDULING
- A. Coordinate with other utility work.

## PART 2 PRODUCTS

- 2.1 MATERIALS
- A. Corrugated Polyethylene Pipe (HDPE, Dual Wall with Smooth Interior): Conform to AASHTO M-294.
    - 1. Classification: Soil-tight, integral bell and spigot joints. Joints shall be sealed with factory installed rubber O-ring gaskets that meet ASTM F-477.
    - 2. Coefficient of Roughness (interior pipe surface): 0.012 maximum (Manning formula).
    - 3. Joint Couplings (Soil-tight): Polyethylene, bell-and-spigot type couplers utilizing an elastomeric gasket conforming to ASTM F-477.
    - 4. Fittings:
      - a. High density polyethylene meeting the properties specified for the pipe.
      - b. Either molded or fabricated.
      - c. Designed specifically for the pipe furnished and manufactured by the pipe manufacturer.
    - 5. Acceptable Manufacturer:
      - a. ProLink ST (N-12 IB ST), Smooth Interior Pipe & Fittings by Advanced Drainage Systems, Inc., (ADS) 3300 Riverside Dr., Columbus, OH 43221; (614) 457-3051
      - b. Approved equivalent.
  - B. High Density Polyethylene Pipe (HDPE) Perforated Pipe: Perforated double wall smooth interior pipe complying with the following:

1. 4" to 10" diameter pipe to conform to AASHTO M 252.
  2. 12" to 36" diameter pipe to conform to AASHTO M 294
  3. Coefficient of Roughness (Interior Pipe Surface): 0.012 maximum (Manning Formula).
  4. Classification: Type S
  5. Joint Couplings: Polyethylene, bell and spigot type couplers utilizing an elastometric gasket conforming to ASTM F 477. Snap on type or split collar through 24" diameter.
  6. Corrugated to match pipe corrugations, width not less than one half the pipe diameter.
  7. Split couplings shall engage an equal number of corrugations on each side of the joint.
  8. Fittings: Either molded or fabricated, high density polyethylene components meeting the properties specified for, and designed specifically for the pipe manufactured by the pipe manufacturer.
  9. Perforated Pipe: Conform to AASHTO M-252 or AASHTO M-294, Type SP with Class I perforations.
  10. Specifications have been based on products manufactured by Advanced Drainage Systems, Inc, Columbus, Ohio (Tel. #614-457-3051) or Hancor, Inc., Findlay, Ohio (Tel. #800-847-5880).
- C. Polyvinyl Chloride (PVC) Pipe for in-line drain piping, solid: Conform to ASTM D-3034 and ASTM F1336 (SDR-35)
1. Conform to shape, dimensions, and thickness shown on the Contract Drawings.
  2. Provide fittings of the same size and pressure rating as the pipe to which they are connected.
  3. Rubber gasketed joints manufactured in accordance with ASTM D-3139.
  4. Rubber gaskets shall comply with ASTM D3212 Internal Pressure Test and Vacuum Test at 5 degrees of gasket joint deflection.
  5. AdvanEdge Pipe and Couplings, as manufactured by Advanced Drainage Systems, Inc., (ADS) 3300 Riverside Dr., Columbus, OH 43221; (614) 457-3051, or approved equivalent.

## 2.2 GEOTECHNICAL FABRIC

- A. Filter Fabric (GeoTextile):
1. Separation for Underdrains: Amoco 2002 & 2004, Contech Construction Products Inc. C-180, Synthetic Industries Geotex 250ST & 315ST, Mirafi Geolon HP570 & HP1500 or approved equivalent.

## PART 3 EXECUTION



3.1 MAINTENANCE OF EXISTING STORMWATER FLOWS

- A. Provide all temporary facilities required to safely and adequately bypass existing stormwater flows from the Work area during construction.
- B. The bypassing of such flows shall prevent any hazards to public health and welfare when the stormwater flows are bypassed from the Work area during construction.
- C. The Contractor is fully responsible for any and all damages to construction, adjacent properties, utilities, and/or buildings in the area caused by these operations.

3.2 INSPECTION

- A. Inspect pipe and fittings before installation. Remove defective materials from the Site.
- B. Concrete pipes shall be free from fractures, cracks, and surface roughness.
- C. Pipe with damaged ends will not be accepted when such damage would prevent making a satisfactory joint.

3.3 INSTALLATION

- A. General Locations and Arrangements: Contract Drawings (plans and details) indicate the general location and arrangement of the underground storm sewerage system piping. Location and arrangements of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical. If, during construction of the project, it becomes necessary to make changes in the location or grades of the sewers, the Engineer will issue appropriate directions after being contacted by the Contractor.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- C. Use manholes or catch basins for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.
- D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.
- E. Install piping pitched down in direction of flow, at minimum slope of 1 percent, except where indicated otherwise.

- F. Extend storm sewerage system piping to connect to building storm drains, of sizes and in locations indicated.
- G. Fill excess excavation with suitable materials and tamp.

### 3.4 STORM SEWER RELATION TO WATER LINE

- A. Horizontal Separation: Storm sewers should be laid at least 10 feet, horizontally, from any existing or proposed water line.
- B. Vertical Separation: Whenever sewers must cross water line, the storm sewer shall be laid at such so there is an 18-inch vertical separation between the two lines. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with push-on joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.
- C. Special Conditions: When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the water main should be constructed of a slip-on or mechanical-joint ductile iron pipe, and the sewer constructed of mechanical-joint ductile iron pipe and both pressure tested to assure water tightness.

### 3.5 PROTECTING PIPE

- A. During the progress of the Work keep pipe clean from all sediment, debris, and other foreign material.
- B. Close all open ends of pipes and fittings securely with removable plugs at end of Work day, during storms, when the Work is left at any time, and at such times as Engineer may direct.

### 3.6 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.
- B. 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 3000-psi 28-day compressive-strength concrete.
- C. Make branch connections from side into existing 4- to 21-inch piping by removing section of existing pipe and installing wye fitting, into existing piping. Encase entire wye with not less than 6 inches of 3000-psi 28-day compressive-strength concrete or,

- D. Make branch connections from side into existing 24-inch or larger piping or to underground structures by cutting opening into existing unit sufficiently large 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 structure 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.
  - 1. Provide concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
  - 2. Use epoxy bonding compound as interface between new and existing concrete and piping materials.
    - a. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

### 3.7 FIELD QUALITY CONTROL

- A. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
  - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
  - 2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
  - 3. Flush piping between manholes, if required by local authority, to remove collected debris.
- B. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
  - 1. Make inspections of pipe between manholes/fittings, after pipe has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
  - 2. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects and re-inspect.
- C. Water Tightness of Sewer Structures: It is the intent of the Contract Drawings and these Specifications that the completed storm sewer lines shall be as watertight and free from infiltration as practical, unless specified otherwise. All visible leaks or points of infiltration shall be repaired.

END OF SECTION 33 41 00

## SECTION 33 49 00 – STORM DRAINAGE STRUCTURES

### PART 1 GENERAL

#### 1.1 This Section includes:

- A. Under this section the Contractor shall provide all labor, equipment and material necessary to furnish, install and test all storm utility drainage structures and fittings as shown on the Contract drawings, specified herein and approved by the Engineer.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 31 20 00: Excavation and Fill
- C. Section 33 41 00: Storm Drainage Piping

#### 1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO)
- B. American Society for Testing and Materials (ASTM)

#### 1.4 PROJECT CONDITIONS

- A. Location of Sewers and Sewer Structures: The location, elevation, and grades of sewers and sewer structures are shown on the Contract Drawings and shall be adhered to as closely as possible. If during construction of the project, it becomes necessary to make changes in the location or grades of the sewers, the Engineer will issue appropriate directions after being contacted by the Contractor.
- B. Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that storm sewerage system may be installed in compliance with original design and referenced standards.

#### 1.5 SUBMITTALS

- A. Shop drawings for precast concrete storm drainage structures, including cast iron frames, grates, covers, precast dry well and infiltrator system components. Submittal shall include installation, inspection and maintenance instructions for the infiltration system.
- B. Product Data: Manufacturer's catalog cuts, specifications, and installation instructions. And manufacturer's certificates.
- C. As-built record drawings at project closeout of installed storm sewerage piping and products. An as-built survey prepared by licensed NYS

Surveyor depicting the installed storm sewer piping and structures including rim and invert elevations of structures pipe size, pipe type, and invert of all piping. Both hard copy and electronic copy shall be provided to the Owner and Engineer.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer data: All products must be produced by a facility that demonstrates five (5) years of experience in the production of similar products.
- B. All material utilized in construction of structures shall comply with all applicable ASTM and NYSDOT standards.
- C. Environmental Compliance: Comply with applicable portions of local health department and environmental agency regulations pertaining to storm sewerage systems.
- D. Utility Compliance: Comply with local utility regulations and standards pertaining to storm sewerage.
- E. All storm sewer system components shall be installed in accordance with applicable plumbing code requirements and in accordance with all license requirements.
- F. All storm sewer construction shall be subject to inspection by the Engineer prior to backfilling.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall check all materials upon delivery to assure that the proper materials have been received.
- B. Contractor shall check the structures for shipping damage prior to installation. Units that have been damaged must not be installed. Contractor shall contact manufacturer immediately upon discovery of any damage.
- C. All material shall be delivered to the site and unloaded with handling that conforms to the manufacturer's instructions for reasonable care.
- D. Protect material from dirt and damage.
- E. All material shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in the handling of the pipe. Storage of the structure on the job shall be in accordance with the manufacturer's recommendations.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Precast Rectangular Reinforced Concrete Drainage Structures:

1. Structure shall be manufactured by the Fort Miller Co. Inc. or approved equivalent.
  2. Structure shall be designed for HS20-44 vehicular loading plus 25% impact.
  3. Riser Sections: ASTM C 478.
  4. Joints Between Riser Sections - One of the following:
    - a. Rubber Gaskets: ASTM C-443.
    - b. Butyl Joint Sealant: ConSeal CS-202 by Concrete Sealants, Inc., or approved equivalent.
  5. Concrete for Precast Units: Air content 6% by volume with an allowable tolerance of 1.5% +/- . Minimum compressive strength of 4,500 PSI after 28 days.
  6. Concrete Reinforcement: Reinforcement for structure shall be designed by a Licensed New York State Professional Engineer prior to construction.
    - a. Welded Wire Fabric: ASTM A 185.
    - b. Steel Bars: ASTM A 615, Grade 60.
  7. Steps:
    - a. Reinforced Plastic: 1/2-inch steel reinforced (ASTM A-615, Grade 60) polypropylene, or other plastic material complying with NYSDOT 725-02.01.
    - b. Capable of withstanding a 300 lb. concentrated live load without permanent distortion and with rungs a minimum 10 inches wide designed to prevent feet from slipping off the ends.
    - c. Manufactured by MA Industries or approved equivalents.
- B. Precast Square Reinforced Concrete Drainage Structure
1. Structure shall be manufactured by the Fort Miller Co. Inc. or approved equivalent.
  2. Structure shall be designed for HS20-44 vehicular loading plus 25% impact.
  3. Structure shall have integral base.
  4. Riser Sections: ASTM C 890, height and width as indicated on the Contract Documents.
  5. Concrete for Pre-Cast Units: Air content 6% by volume with an allowable tolerance of +/-1.5%. Minimum compressive strength of 4,500 psi after 28 days.
  6. Pre-Cast Concrete Structure Load Rating: AASHTO HS-20 with 30% impact and 130 lb/cf equivalent soil pressure.
    - a. Casting Load Rating: AASHTO H20 wheel loading requirements. Manufacture, workmanship and certified proof-load tests shall conform to AASHTO M306-89 Standard Specification for Drainage Structure Castings.

- b. Coatings: Minimum one shop coat of asphaltum to be applied to all frame and grate surfaces.
    - c. Acceptable Casting: As indicated on Contract Drawings.
- C. Frames, Grates, and Covers for Precast Reinforced Concrete Drainage Structures:
  - 1. Style: Heavy Duty Frame and Grate Assembly
  - 2. Size: 30" x 48"
  - 3. Frame and Grate: Provide castings of uniform quality, free from blow holes, porosity, hard spots, shrinkage defects, cracks or other injurious defects. Manufacture all castings true to pattern and free from surface imperfections. Provide heavy duty frames and grates with machined horizontal bearing surfaces.
  - 4. Design of each shall be the same throughout the project unless otherwise specified or indicated on the Contract Drawings.
  - 5. Units shall meet AASHTO HS20-44 vehicular loading plus 25% impact. Manufacturer, workmanship and certified proof-load tests shall conform to AASHTO M306-89-Standard Specification for Drainage Structure Castings.
  - 6. A.D.A. and Bicycle compliant.
  - 7. Material:
    - a. Cast iron: ASTM A48, Class 30B or 35B.
    - b. Delivered to site free of any coatings, unless otherwise specified.
- F. Basin and Grate for Yard Inlet Basins:
  - 1. In-Line Drain and Grate: As manufactured by Nyloplast-ADS or equivalent, 13.5" by 13.25" in-line drain with cast iron HS20-44 rated grate.
  - 2. Grate: Round domed ductile iron model 1899CGD and 0899CGD by NYLOPLAST, or approved equivalent.
  - 3. Acceptable Drainage Structure Basin and Grate: Pattern 1899CGD and 0899CGD by NYLOPLAST, or approved equivalent.
- G. Frame, Grate and Cover for Storm Manholes:
  - 1. Heavy Duty, Round Frame and Grate or Frame and Cover Assembly
  - 2. Size: 24" diameter
  - 3. Grates shall be A.D.A. and Bicycle compliant.
  - 4. Material:
    - c. Cast iron: ASTM A48, Class 30B or 35B.
    - d. Delivered to site free of any coatings, unless otherwise specified.
- H. Pipe-to-Drainage Structure Connection:
  - 1. Non-shrink cement mortar, ASTM C 270, Type M.
  - 2. Concrete Coating: Waterborne, non-flammable, VOC Compliance, 3 mil dry film thickness, catonic asphalt emulsion (55% - 60%

petroleum asphalt), PGS 96 by Pipe Gasket & Supply Co., 2701 South Coliseum Boulevard, Suite 1010, Fort Wayne, Indiana, 46003, (219) 426-4575, or approved equivalent.

- I. Materials for use in mortar shall conform to the following requirements:
  1. Cement: Cement shall conform to the Standard Specifications for Portland Cement, ASTM Serial Designation C150 with latest amendments.
  2. Sand: Sand shall be sharp, clean, free from deleterious substances and shall be uniformly graded and shall conform to the "Standard Specification for Aggregate for Masonry Mortar", ASTM C144 with the latest amendments.
  3. Water: Water used in making mortar or concrete shall be clean and free from oil, alkali, sugar or other deleterious substances. When potable water is in reach, no other water shall be used.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Construct structures with precast reinforced riser sections to the dimensions shown on the Contract Drawings. Seal joints between precast riser sections with material specified. Install steps 12 inches o.c. from top to bottom and in a manner capable of withstanding a lateral pull of 1,000 lbs.
- B. Position tops of structures flush with finished grade.
- C. All lifting holes shall be sealed by driving a tapered rubber plug into to hole and filling the remaining void with a non-shrink grout.
- D. Cast iron frames, grates and covers shall be set to the proper elevation in a full bed of mortar. The frame shall be completely mortared onto the manhole as shown on the Contract Drawings.
- E. Temporary Shoring: Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of existing structures and construction to remain. Strengthen or add new supports when required during progress of selective demolition.

#### 3.2 BRICK TO BRING STORM DRAINAGE STRUCTURE TO GRADE

- A. Brick shall be used in conjunction with precast concrete spacers to bring frames to grade for heights under twelve (12) inches in the following manner:
  1. Bricks shall be thoroughly wet when used and each brick shall be laid in a full bed of mortar including side and end joints. Normal 3/8 inch joints shall be used except when the brick is laid radially, in



which case the narrowest part of the joint will not exceed  $\frac{1}{4}$  inch. Brick shall be laid neatly with sufficient width to adequately support the cast iron frame. The entire stack shall be completely plastered on the exterior side when initially constructed. The brick work shall be kept moist for a period of five (5) days after completion and adequately protected to prevent freezing during cold weather. The interior of the brick shall be neatly plastered once final grading and paving is completed so that the frame and cover will not be disturbed by additional work.

### 3.3 CHAMBER INSTALLATION AND BACKFILLING

- A. Excavation must be free of standing water. Dewatering measures must be taken if required.
- B. Prepare the chamber bed's subgrade soil as outlined in the Contract Drawings. Requirement for subgrade soil bearing capacity should meet or exceed the chamber manufacturer's required allowable subgrade soil bearing capacity. The Contractor must report any discrepancies with subgrade soil's bearing capacity to the Engineer.
- C. Install chamber system flat or at constant slope between points and elevations indicated.
- D. Construct fabric and stone foundation per chamber manufacturer's installation instructions.
- E. Construct the chamber bed by joining the chambers lengthwise in rows. Attach chambers by overlapping the end corrugation of one chamber onto the end corrugation of the last chamber in the row.
- F. See pipe manufacturer's installation instructions for pipe assembly.
- G. Stone placement between chamber rows and around perimeter must follow instructions as indicated in the most current version of the chamber manufacturer's installation instructions.
- H. The contractor must refer to the chamber manufacturer's installation instructions for a table of acceptable vehicle loads at various depths of cover. The contractor is responsible for preventing vehicles that exceed the chamber manufacturer's requirements from traveling across or parking over the chamber system. Temporary fencing, warning tape and appropriately located signs are commonly used to prevent unauthorized vehicles from entering sensitive construction areas.
- I. Refer to the chamber manufacturer's installation instructions for minimum requirements for backfill material above the stormwater chamber system.
- J. See pipe manufacturer's installation instructions for guidance on installing the plastic pipe fittings to the chamber system.

- K. Protect all inlets to the stormwater chamber system during construction. Once construction has ceased, the pipe plugs are removed to allow normal system functionality.

#### 3.4 FIELD QUALITY CONTROL

- A. Cleaning: Clear interior of structures of dirt and other superfluous material as work progresses.
- B. Flush piping between manholes, if required by local authority, to remove collected debris.
- C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
- D. Make inspections of pipe between manholes/fittings, after pipe has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
- E. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects and re-inspect.
- F. Water Tightness of Storm Sewer Structures: It is the intent of the Contract Drawings and these Specifications that the completed storm sewer structure shall be as watertight and free from infiltration as practical. All visible leaks or points of infiltration shall be repaired.

END OF SECTION 33 49 00

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