

PARETTE  
SOMJEN



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## SPECIFICATIONS

for the proposed:

### Renovations at

### 733 Cedarbridge

PSA COMMISSION NUMBER: 8193

for the

### Lakewood Fire District No. 1

439 Route 46 East  
Rockaway, NJ 07866  
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04 DECEMBER 2019



DOCUMENT 00 01 10

TABLE OF CONTENTS

Section #      Section Title

**PART 1 - PROCUREMENT**

DIVISION 0 – PROCUREMENT AND CONTRACTING

MISCELLANEOUS DOCUMENTS

00 01 01      Cover Page  
00 01 10      Table of Contents

**PART 2 – GENERAL REQUIREMENTS**

DIVISION 1 – GENERAL REQUIREMENTS

01 10 00      Summary  
01 20 00      Price and Payment Procedures  
01 21 00      Allowances  
01 23 00      Alternates  
01 26 00      Contract Modification Procedures  
01 30 00      Administrative Requirements  
01 31 00      Project Management and Coordination  
01 31 13      Project Coordination  
01 31 19      Project Meetings  
01 31 19.13      Preconstruction Meetings  
01 32 00      Construction Progress Documentation  
01 32 13      Scheduling of Work  
01 32 33      Photographic Documentation  
01 33 00      Submittal Procedures  
01 50 00      Temporary Facilities and Controls  
01 57 29      Temporary Indoor Air Quality Controls  
01 60 00      Product Requirements  
01 66 00      Product Storage and Handling Requirements  
01 73 00      Execution  
01 73 29      Cutting and Patching  
01 74 19      Construction Waste Management and Disposal  
01 77 00      Closeout Procedures  
01 78 23      Operation and Maintenance Data  
01 78 39      Project Record Documents

**PART 3 - SPECIFICATIONS**

DIVISION 2 – EXISTING CONDITIONS

02 41 19.13      Selective Building Demolition

DIVISION 3 – CONCRETE

03 54 16      Hydraulic Cement Underlayment

DIVISION 5 – METALS

05 40 00 Cold-Formed Metal Framing

DIVISION 6 – WOODS, PLASTICS, AND COMPOSITES

06 10 00 Rough Carpentry  
06 10 53 Miscellaneous Rough Carpentry  
06 41 00 Architectural Wood Casework

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07 84 00 Firestopping  
07 90 00 Joint Protection

DIVISION 8 – OPENINGS

08 11 03 Hollow Metal Doors and Frames  
08 14 16 Flush Wood Doors  
08 51 13 Aluminum Windows  
08 71 00 Door Hardware  
08 80 00 Glazing

DIVISION 9 – FINISHES

09 21 16 Gypsum Board Assemblies  
09 30 00 Tiling  
09 51 23 Acoustical Tile Ceilings  
09 54 23 Linear Metal Ceilings  
09 68 13 Tile Carpeting  
09 90 00 Painting and Coating

DIVISION 10 – SPECIALTIES

10 26 00 Wall and Door Protection

DIVISION 12 – FURNISHINGS

12 24 13 Roller Window Shades

DIVISION 22 – PLUMBING

22 05 17 Sleeves and Sleeve Seals for Plumbing Piping  
22 05 18 Escutcheons for Plumbing Piping  
22 05 23 General-Duty Valves for Plumbing Piping  
22 05 29 Hangers and Supports for Plumbing Piping and Equipment  
22 05 53 Identification for Plumbing Piping and Equipment  
22 07 19 Plumbing Piping Insulation  
22 11 16 Domestic Water Piping  
22 13 16 Sanitary Waste and Vent Piping  
22 40 00 Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATION, AIRING, AND COOLING (HVAC)

23 05 13 Common Motor Requirements for HVAC Equipment  
23 05 29 Hangers and Supports for HVAC Piping and Equipment  
23 05 93 Testing, Adjusting, and Balancing for HVAC  
23 07 00 HVAC Insulation  
23 23 00 Refrigerant Piping  
23 31 13 Metal Ducts

23 33 00	Air Duct Accessories
23 37 13	Diffusers, Registers, and Grilles
23 81 26	Split-System Air-Conditioners

DIVISION 26 – ELECTRICAL

26 05 00	Common Work Results for Electrical
26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 29	Hangers and Supports for Electrical Systems
26 05 33	Raceway and Boxes for Electrical Systems
26 05 53	Identification for Electrical Systems
26 27 26	Wiring Devices

END OF DOCUMENT 00 01 10

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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## SECTION 01 10 00

## SUMMARY

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 RELATED SECTIONS / DOCUMENTS

- A. Section 01 21 00 "Allowances."
- B. Section 01 50 00 "Temporary Facilities and Controls."

## 1.3 CONTRACT DESCRIPTION

- A. The scope of this project includes, but is not limited to, the renovation of existing meeting room and existing kitchenette into new meeting room, offices, expanded break area, and replacement of existing lighting with new led light fixtures at existing restrooms, corridor, and vestibules.
  - 1. Perform Work of Contract under fixed cost contract with Owner in accordance with Conditions of Contract.

## 1.4 WORK SEQUENCE

- A. Construct Work to accommodate Owner's occupancy requirements during construction period, coordinate construction schedule and operations with Owner and Architect.

## 1.5 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Confine operations to areas within phasing and contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
  - 1. Driveways and Entrances: Keep driveway and entrance serving the Project clear and available to the building, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
  - 2. Limits of Work: Contractor shall confine operations at site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber site areas with any materials or equipment. Contractor shall obtain Architect's and Owner's approval for location of all temporary facilities, storage, office, sheds, signs, etc.
  - 3. Protection: The Contractor shall use every available precaution to provide for the safety of adjacent property owners, visitors to the site, the general public and all connected with the work under this contract.
  - 4. Restoration of Site: As requirement for the completion of his work, each contractor shall restore the site area to its original condition as agreed to with the Architect. This includes, but is not limited to the grading, providing topsoil and seeding and removal of surplus or excavated material from the site. Trenches and ruts made by the Contractor's vehicles, including ruts and breaks in macadam areas, are required to be filled and smoothed out and / or patched by the contractor. Contractor is responsible to take photos of areas prior to construction and submit at beginning of project. Without such photos, any

- damage discovered during construction will be contractor's responsibility.
5. Coordination of Site with Architect: The Contractor shall coordinate use of the premises with the Owner and Architect. All material deliveries and storage must be approved by the Architect in advance.
  6. Avoid Disturbances: The Contractor shall execute the Work of this contract as quietly as possible to avoid unnecessary disturbances. The contractor will avoid verbal and physical contact with building staff and users.
  7. Store all construction materials in a safe and secure manner.
  8. Provide and maintain fences around construction supplies or debris.
  9. The Contractor shall comply with the Owner's Site Security Programs as administered by the District including Contractor badging. Each employee of the Contractor will be supplied a badge by the Owner. This badge must be worn at all times while on the construction site. No Contractor will be allowed access to the existing building without a badge and prior approval from the District.
  10. All Personnel shall dress in clothing appropriate to the work they perform. All personnel are to wear shirts, hardhats, safety shoes, glasses, gloves, masks or respirators, noise protection devices, and other protective clothing and equipment as required by OSHA standards.
  11. For the safety of students, staff and the public, the use of a crane to lift any items on the roof can not be performed over an occupied building. This work must be scheduled and coordinated with the Owner and Architect. The Contractor shall provide additional barricades around the crane as required at all times. Any crane work to be done after hours and included in base bid.
  12. The Contractor is responsible for maintaining all temporary emergency egress routes. The Contractor shall obtain approval from the Building and Fire Departments for all temporary emergency egress routes.
  13. The Owner has the right to require disruptive work to be discontinued if affecting the students and staff.

#### 1.6 OCCUPANCY REQUIREMENTS

- A. Occupancy: The Owner will occupy the existing buildings and surrounding areas during the entire construction period. Cooperate with the Owner and Architect during construction operations to minimize conflicts and facilitate District's usage. Perform the Work so as not to interfere with the District's operations.
  1. Maintain all existing building exits during construction as directed and approved by the local code official, Architect and Owner.
  2. Comply with the following restrictions:
    - a. Use of offensive or inappropriate language is strictly forbidden.
    - b. The use of radios, tape and CD players is prohibited on the site and in the building.
    - c. No smoking is allowed on property, including construction areas.
    - d. No alcoholic beverages are allowed on property, including construction areas.

#### 1.7 PHOTOGRAPHS

- A. The Contractor shall take as many digital photographs of the overall project as necessary to record existing conditions within 48 hours after issuance of a Notice to Proceed.
- B. The Contractor shall take a minimum of 12 digital photographs on the 15th of each month. These photographs shall be submitted with the monthly pay applications.
- C. The Contractor shall take a minimum of 24 digital photographs upon Substantial Completion



of his Contract.

- D. The Architect shall be furnished with 2 prints or digital copies taken from each of the above required photographs.
- E. The Contractor shall submit (6) six construction progress photos with each payment application.
- F. The Contractor shall avoid taking photographs of building users.

#### 1.8 SECURITY REQUIREMENTS

- A. Contractor personnel will be required to wear Identification badges at all times and badging requirements are as follows:
  - 1. Key Personnel (super's, pm's, arch., emergency contact's, etc.)
    - a. Key personnel shall be required to have a picture badge with an approved logo on it. Picture badges will be issued to the key personnel by the District. This will require that a digital photograph be taken to produce the badge.
  - 2. Construction Personnel:
    - a. Construction personnel will be required to have a picture ID to perform work on site. (driver's license, State issued ID, etc.).
    - b. Construction personnel will be required to sign-in and out each day on a daily log as kept by the contractor to receive a daily work badge.
    - c. A (1) one day standard temporary badge with logo only on it will be issued to the contractors employees by the key personnel who is responsible for that employee.
    - d. This temporary badge can be issued only by key personnel with a picture ID and as approved by the District.
    - e. Employee shall wear badges at all times during construction.

#### 1.9 OUTAGES

- A. When required, utility and service outages shall be kept to a minimum and will be permitted only with written approval of Owner. Outages that will, in the opinion of the Owner, unreasonably affect the building occupants must be completed after hours or on the weekend at no additional cost.
- B. Requests for outages will not be considered unless they include and identify all areas that will be affected by the proposed outage.
- C. All requests for outages shall be made to the Architect a minimum of ten (10) working days in advance of their need.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 01 10 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Schedule of values.
- B. Applications for payment.

1.2 RELATED SECTIONS

- A. Section 01 10 00 "Summary."
- B. Section 01 21 00 "Allowances."
- C. Section 01 23 00 "Alternates."
- D. Section 01 26 00 "Contract Modification Procedures."
- E. Section 01 32 13 "Scheduling of Work."

1.3 SCHEDULE OF VALUES

- A. Submit printed schedule of values on AIA Form G703 - Continuation Sheet for G702. Contractor's standard form or electronic media printout will be considered.
- B. Submit Schedule of Values in duplicate within 15 days after date established in Notice to Proceed for approval by the Architect.
- C. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of major specification Section. Identify site mobilization, bonds and insurance, temporary protection, safety, cleanup, quality, as built documents, closeouts and demobilization.
- D. Include as separate line items, amount of Allowance(s) specified in Section 01 21 00.
- E. Revise schedule of values to list approved Change Orders with each Application for Payment.
- F. Include separate line items for punch list and project closeout equal to 2% each of contract sum.

1.4 APPLICATIONS FOR PAYMENT

- A. Submit three copies of each application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Initial Application for Payment may not be approved unless contractor submits a construction schedule as required by the Project Manual. Submit updated construction schedule as outlined in Section 01 32 13 with each subsequent Application for Payment.
- D. Payment Period: Submit at intervals stipulated in the Agreement.
- E. Submit with transmittal letter as specified for Submittals in Section 01 33 00.
- F. Include the following with each Application for Payment:
  - 1. Certified Payroll
  - 2. Partial release of liens from major subcontractors and vendors.
  - 3. AIA - G703 Schedule of values.

4. Approved Change orders.
  5. Appropriate retainer held.
  6. Safety Report.
  7. Prevailing Wage Report.
  8. Updated Right to Know Report on hazardous materials and / or equipment stored on site. Forms are available on line at <http://web.doh.state.nj.us/apps2/forms/subforms.aspx?pro=ohs>
  9. Construction progress schedules, revised, current and approved by the Architect.
  10. Six (6) Construction Progress Photos.
- G. Substantiating Data: When Architect requires substantiating information, submit data justifying dollar amounts in question.
1. Current construction photographs.
  2. Affidavits attesting to off-site stored products.

#### 1.5 UNIT PRICES

- A. Take measurements and compute quantities. Architect will verify measurements and quantities.
- B. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services, bonding and other incidentals; erection, application or installation of item of the Work; overhead and profit.
- C. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Architect multiplied by unit sum/price for Work incorporated in or made necessary by the Work.
- D. Measurement Of Quantities:
  1. Measurement by Area: Measured by square dimension using mean length and width or radius.
  2. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.
- E. Unit Price Schedule: See Section 00 43 00 for list of Unit Prices, if applicable.

PART 2 PRODUCTS (Not Used).

PART 3 EXECUTION (Not Used).

END OF SECTION 01 20 00

## SECTION 01 21 00

## ALLOWANCES

## PART 1 GENERAL

## 1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. Section 01 26 00 "Contract Modification Procedures." Designate delivery dates for product in Project Schedule.

## 1.2 GENERAL ALLOWANCE

- A. Use of General Allowance will be at the direction of the Architect.
- B. General Allowance Amounts which should be included in the Contract Price are listed in Section 00 43 00 "Bid Form Supplements." Such General Allowance shall be labeled "general allowance" and appear on the schedule of values as a separate line item from which monies may be drawn. AIA document G701, Change Order will be used for tracking purposes of General Allowance monies.
- C. Include in base bid, for inclusion in Contract Price, Contractors costs for:
  - 1. General Contractor's Supervision of any work which is drawn from or paid through General Allowance
  - 2. General Contractor Overhead and Profit
  - 3. Insurance and Bonding.
- D. These items shall not be drawn from general allowance but shall already be calculated into base bid based on amount of general allowance designated.
- E. All General Allowance deductions shall be processed as Change Orders in accordance with Section 01 26 00 "Contract Modification Procedures."

## 1.3 ALLOWANCES FOR PRODUCTS/MATERIALS

- A. Purchase product/material under allowance only as directed by Architect.
- B. Allowance amounts which should be included in the Contract Price are listed in Document 00 43 00 "Bid Form Supplements."
- C. Amount of allowance shall include:
  - 1. Net cost of product.
  - 2. Delivery to the site.
  - 3. Applicable taxes.
  - 4. Labor, installation, and finishing
- D. In addition to amount of allowance, include in base bid, for inclusion in Contract Price, Contractor's costs for:
  - 1. Handling at site including unloading, uncrating, and storage.
  - 2. Protection from elements, from damage.
  - 3. Other expenses (e.g., testing, adjusting, and balancing) required to complete installation.
  - 4. Overhead and profit.
  - 5. Insurance and Bonding.
  - 6. Supervision.

#### 1.4 SELECTION OF PRODUCT/MATERIAL

- A. Architect's Duties
  - 1. Consult with Contractor in consideration of product/material and suppliers.
  - 2. Make selection, designate product/material to be used.
  - 3. Notify Contractor in writing, designating:
    - a. Product, size, color, and texture.
    - b. Supplier.
    - c. Cost, delivered at site.
  
- B. Contractor's Duties
  - 1. Assist Architect in determining qualified suppliers.
  - 2. Obtain 3 or more proposals from suppliers unless directed otherwise by the Architect.
  - 3. Make appropriate recommendations for consideration by Architect.
  - 4. Notify Architect, in writing, of effect anticipated by selection of product or supplier under consideration on:
    - a. Project Schedule.
    - b. Contract Price
  
  - 5. On notification of selection enter into purchase agreement with designated supplier.

#### 1.5 DELIVERY

- A. Contractor Responsibility:
  - 1. Arrange for delivery and unloading.
  - 2. Promptly inspect product for damage or defects.

#### 1.6 INSTALLATION

- A. Comply with reference Specification Section requirements.

#### 1.7 ADJUSTMENT OF CASH ALLOWANCES

- A. Unused amounts of monies included under allowances shall be credited to the Owner by deduct Change Order prior to approval of Final Application for Payment.

PART 2 — PRODUCTS (Not Applicable)

PART 3 — EXECUTION (Not Applicable)

END OF SECTION 01 21 00

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including but not limited to, General and Supplementary Conditions and other Division 1, Specification Sections, apply to work of this Section.

1.2 DESCRIPTION OF REQUIREMENTS

- A. Definition: An Alternate is an amount proposed by Bidders and stated on the Bid Form that will be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding Change in either Work or in products, materials, equipment, systems or installation methods described in Contract Documents.
- B. Coordination: Coordinate related work and modify or adjust adjacent work as required to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project.
- C. Notification: Immediately following award of Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates, if any.
- D. Schedule: A list of Alternates is included on drawing T1.00 and enumerated throughout the bidding drawings.
- E. Include as part of each Alternate, miscellaneous devices, appurtenances and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 23 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  - 2. Within 10 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
  - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
- C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.5 CHANGE ORDER PROCEDURES

- A. The Contractor shall submit a written proposal within ten (10) days of receiving a Contract Change Request from the Architect.
- B. Proposals shall be submitted on Contract Change Request forms and Cost Estimate Detail Sheets provided by the Owner/Architect.
- C. Proposals shall be with maximum charges being the amounts actually incurred or the maximum rates permitted herein, whichever is less. Proposals shall be prepared in accordance with paragraph 1.6.

- D. Construction Change Request Proposals, upon approval by the Owner’s Authority, will be incorporated into the Contract by Change Order.
- E. Timely processing of changes is the essence of project control. Delays in processing a change can have serious impact on shop drawing preparation, schedule, project funding, cash flow projections, and claims. Every effort must be made to expedite the processing of changes from their inception to their final contract amendment and/or Owner approved change orders.

1.6 ADDITIVE CHANGES

- A. Direct Labor Costs: Direct labor costs are estimated labor costs developed by estimating the number of craft hours necessary to perform the change multiplied by the hourly cost for the particular trade involved or state prevailing/union hourly labor.
  - 1. Premium time rates for trade labor shall be calculated in accordance with legal requirements governing wages, hours, and prevailing labor agreements. When determining wage rates for inclusion in trade contracts or amendments to trade contracts, the following guidelines should be applied:

	STRAIGHT TIME	TIME AND HALF	DOUBLE TIME
Wage Rate	Basic rate	1.5 x Basic Rate	2 x Basic Rate
Taxes (FICA, FUTA, SUTA) Approx. 11-14% of Wage Rate	Yes	Yes	Yes
Fringes	Yes	Yes*	Yes*
Workman’s Comp.	Yes	No**	No**
Bond (Approx. 1%)	Yes	Yes	Yes
General Liability Insurance	Yes	Yes***	Yes***
Overhead/Profit	No	No	No
Labor Efficiency	N/A	No	No

**NOTES:**

\*Fringes – Allowed per NJDOL Prevailing Wage Rate Rules by Trade.

\*\* W/C – Calculated on actual hours of worked only (i.e. Time exposed to risk)

\*\*\* G/L – Based on either a percentage of labor dollars or a percentage of gross sales.  
Labor \$ = Wage Rate without mark-ups. Gross Sales \$ = Wage Rate with mark ups.

- 2. Basic Wages/Fringe Benefits: Hourly rates and fringe benefits shall be stated. Direct supervision shall not exceed fifteen percent (15%) of the cost of direct labor and if a working supervisor's hours are covered, other supervision shall not be allowed.
  - a. Non-working supervision shall not be included in change order.

3. Worker's Insurance: Direct contributions to the State of New Jersey such as industrial insurance, medical aid and supplemental pension, by the class and rates established by the State of New Jersey.
  4. Federal Insurance: Direct contributions required by the Federal Insurance Compensation Act, (FICA); Federal Unemployment Tax Act (FUTA) and the State Unemployment Compensation Act (SUCA).
  5. All wages must verifiable by certified payroll.
  6. Wage rates can only include the items listed in the table above. No additional items will be allowed or considered to be included in the wage rates.
- B. Direct Material Costs: Direct material costs are an itemization of the estimated quantity and cost of materials necessary to perform the proposed change. Material pricing shall be developed from actual known costs, supplier quotations or standard industry pricing guides. Material costs shall consider all offered or available discounts and rebates. Freight costs, express charges or special delivery charges shall be itemized.
- C. Construction Equipment Costs: Construction equipment costs are an itemization of the type of equipment and the length of time the construction equipment will be used on the proposed change. Cost will be allowed for construction equipment only if used for the changed work or additional rental costs are actually incurred by the Contractor. Equipment cost shall be developed from one of the following sources:
1. Current rental rates established by National Contractor's Association for equipment or supplier quotations.
  2. If equipment is required for which a rental rate is not established in any of the above, an agreed rate shall be established for the equipment using the Data Quest Rental rate (Blue Book), or similar as a basis for verifying rates.
  3. Such rates and the use of the equipment on the work must be approved by the Owner prior to performing the work.
- D. Subcontractor Proposals: Subcontractor Proposals are to be itemized as specified in paragraphs A., B., and C. above.
- E. Overhead and Profit by the Contractor Actually Performing the Work: Cost not to exceed ten percent (10%) overhead and five percent (5%) profit for the party performing the work will be based upon the value of labor, material and the use of construction equipment as defined in paragraphs A., B., and C. above. This cost shall compensate the Contractor for all costs associated with the performance of the change in work.
1. Overhead and Profit by the Contractor on Subcontractors Actually Performing the Work
    - a. The Contractor's fee on work performed by a subcontractor will be based upon the net increased cost to the subcontractor as applicable. Maximum allowable markups on charges will not exceed five percent (5%) for overhead and profit.
    - b. No direct labor by the Contractor will be allowed to be added to a subcontractor's proposal. Costs incurred by the Contractor that are in excess of the allowable markup specified in paragraph e.1, must be detailed in accordance with paragraphs A., B., and C.
  2. Cost of Any Increase or Decrease in Premium by Insurance and Bond caused by the Change shall be considered a direct cost and is to be added after overhead and profit have been calculated.
  3. All Change Orders drawn from General Allowance, as defined in Section 01 21 00, shall not include Overhead and Profit, Bonding, General Liability Insurance, or Supervision.

1.7 DEDUCTIVE CHANGES

- A. The Contractor shall itemize Deductive Changes as required in paragraph 1.6 – Additive Changes, subparagraphs A. through E.

1.8 COMBINED ADDITIVE AND DEDUCTIVE CHANGES

- A. If a Change in the Work involves both additive and deductive Changes for the same type of work, the appropriate overhead and profit amounts allowed will be added to the net difference of items of direct labor, material, construction equipment, small tools and upper Subcontractor proposals.
- B. If other unrelated Additive Changed items are included in the same Change Proposal, the appropriate overhead and profit allowed is to be applied to these individual changed items.

1.9 TIME AND MATERIAL (T&M) WORK:

- A. When it is authorized in writing by the Architect, the cost of the Change shall be based on actual cost for time and materials spent on work performed. The Contractor shall confirm to the following:
  - 1. Labor must be identified on worker's daily time sheets.
  - 2. Time sheets must be submitted within two (2) working days for Architects' review and approval.
  - 3. If supervisor's hours are included as an itemized labor cost, supervision markup will not be allowed.
  - 4. Material Charges must be supported by invoices.
  - 5. The Contractor shall not exceed any cost limit(s) without prior written approval.

1.10 DISAGREEMENTS:

- A. In the event the Contractor does not agree upon the adjustment recommended to the Owner by the Architect in Contract compensation amount, scope of work, or time extension, the following shall apply:
  - 1. Adjustments:
    - a. Upon completion of the change proposal, the Contractor shall either accept the proposal as adjusted, or within ten (10) days of receipt of the adjustment, notify the Architect in writing of any disagreement in the manner specified in paragraph 2. below, Written Notice.
    - b. Invoicing for changes constitutes Contractor's acceptance of the change scope, the dollar value, and extension of time (if any) unless invoicing occurs after notice has been submitted to the Owner for disputed proposals.
  - 2. Written Notice:
    - a. When the Contractor disagrees with either a Contract interpretation or a processed CCR, a letter shall be submitted to the Architect as outlined below:
    - b. Explain the nature of the disagreement and the Contractor's position.
    - c. Outline applicable Sections of the Contract Documents and explain which Sections support the Contractor's position.
    - d. In the event that monetary compensation is sought, provide detailed cost breakdown of compensation requested.

- e. Provide documentation which supports a request for other the monetary relief, including updated project schedule for any request for time extension.
3. Direct the Contractor to do the Work: The Architect may direct the Contractor to proceed with the Work by issuance of a written Construction Change Directive authorization pending resolution of disputed items.
4. Change disputes: The Architect and the Contractor shall review and negotiate the items in disagreement in an effort to clarify and resolve the dispute. All resolutions shall be incorporated into a Contract Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- A. Requirements for coordination.
  - 1. Section 01 31 13 "Project Coordination."
- B. Coordination and Project Conditions.
  - 1. Section 01 31 13 "Project Coordination."
- C. Requirements for preinstallation meeting.
  - 1. Section 01 31 19.13 "Preconstruction Meetings."

END OF SECTION 01 30 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  1. Administrative and supervisory personnel.
  2. Project meetings.
  3. Requests for Interpretation (RFIs).

1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
  1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  1. Preparation of Contractor's Construction Schedule.
  2. Preparation of the Schedule of Values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.
  9. Project closeout activities.

1.4 SUBMITTALS

- A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project

site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

## 1.5 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within four days of the meeting.
- B. Progress Meetings: Conduct progress meetings at biweekly intervals. Coordinate dates of meetings with preparation of payment requests.
1. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Sequence of operations.
      - 2) Status of submittals.
      - 3) Temporary facilities and controls.
      - 4) Hazards and risks.
      - 5) Status of correction of deficient items.
      - 6) Field observations.
      - 7) RFIs.
      - 8) Pending changes.
      - 9) Status of Change Orders.
  2. Minutes: Architect will record and distribute to Contractor the meeting minutes.
  3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
    - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

## 1.6 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
  - 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
  - 2. RFI's may also be referenced as "Requests for Information".
  
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
  - 1. Project name.
  - 2. Date.
  - 3. Name of Contractor.
  - 4. Name of Architect.
  - 5. RFI number, numbered sequentially.
  - 6. Specification Section number and title and related paragraphs, as appropriate.
  - 7. Drawing number and detail references, as appropriate.
  - 8. Field dimensions and conditions, as appropriate.
  - 9. Contractor's suggested solution(s). If Contractor's solution(s) affect the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  - 10. Contractor's signature.
  
- C. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Include the following:
  - 1. Project name.
  - 2. Name and address of Contractor.
  - 3. Name and address of Architect.
  - 4. RFI number including RFIs that were dropped and not submitted.
  - 5. RFI description.
  - 6. Date the RFI was submitted.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 01 31 13

PROJECT COORDINATION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. Provisions established within the General and Supplemental Conditions of the Contract, Specifications, and Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

- A. Coordination of Work of the Contract.

1.3 RELATED SECTIONS

- A. Section 01 31 19 "Project Meetings."
- B. Section 01 73 29 "Cutting and Patching."

1.4 DESCRIPTION

- A. Coordination of scheduling, submittals, and Work of the various Sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

1.5 MEETINGS

- A. In addition to Project Meetings specified in Section 01 31 19 "Project Meetings," hold Coordination Meetings and Pre-installation Conferences with personnel and subcontractors to assure coordination of Work.

1.6 GENERAL COORDINATION

- A. The Contractor must obtain all necessary permits from the electrical, plumbing, fire and construction code authorities, prior to site mobilization. No work and activity on property is to be performed before these permits have been obtained. Contact the municipality for any other permits or unique requirements for construction in their jurisdiction.
- B. Coordinate all portions of the Work under the Contract. Require subcontractor(s) to coordinate their portion of the Work and provide their requirements for coordination of their work with other related Work.
- C. Coordinate mechanical and electrical Work with that of other trades in order that various components of systems are installed at proper time, fit available space, and allow proper service access to those requiring maintenance, including equipment specified in other Divisions.
- D. Coordinate Work of subcontractors having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate use of project space and sequence of installation of mechanical, plumbing, and electrical work that is indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance,

- and for repairs.
- F. In normally occupied areas, except as otherwise shown, conceal pipes, ducts, conduit, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements. Provide escutcheon plates at penetrations through finished surfaces with finish appropriate to adjacent finish surface.
  - G. Coordination Drawings: Before materials are fabricated or Work begun, prepare coordination drawings including plans, elevations, sections, and other details as required to clearly define relationships between sleeves, piping, ductwork, conduit, ceiling grid, lighting, fire sprinkler, HVAC equipment and other mechanical, plumbing and electrical equipment with other components of building such as beams, columns, ceilings, and walls.
    - 1. Hold coordination meetings with trades providing the above work, to coordinate work of the trades for each floor and mechanical areas.
    - 2. Prepare coordination drawings to 1/4" = 1'-0" scale or larger for general layout and 3/8" = 1'-0" for plans and sections in congested areas such as equipment spaces.
    - 3. Resolve conflicts between trades, prepare composite coordinate drawings and obtain signatures on original composite coordination drawings.
    - 4. When conflicts cannot be resolved, Contractor shall request clarification prior to proceeding with that portion of the Work affected by such conflicts or discrepancies. Prepare interference drawings to scale and include plans, elevations, sections, and other details as required to clearly define the conflict between the various systems and other components of the building such as beams, columns, and walls, and to indicate the Contractor's proposed solution.
    - 5. Submit drawings for approval whenever job measurements and an analysis of the Drawings and Specifications by the Contractor indicate that various systems cannot be installed without significant deviation from the intent of the Contract. When such an interference is encountered, cease work in the general areas of the conflict until a solution to the question has been reviewed by the Architect.
    - 6. Submit original composite coordination drawings as part of record document submittals specified in Section 01 33 00 "Submittal Procedures."
  - H. Remove and relocate items at no additional cost to the Owner, which are installed in a manner which prevents necessary future access.

#### 1.7 COORDINATION OF EQUIPMENT AND MATERIALS

- A. Schedule and coordinate submittals specified in Section 01 33 00 "Submittal Procedures."
- B. Coordinate Work of various subcontractors having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate requests for substitutions to assure compatibility of space, of operating elements, and affect on Work of other subcontractors.

#### 1.8 COORDINATION OF CONTRACT CLOSEOUT

- A. Coordinate completion and cleanup of Work of separate subcontractors in preparation for Substantial Completion.
- B. After Owner's occupancy of premises, coordinate access to site by various subcontractors for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

- C. Assemble and coordinate closeout submittals specified in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 31 13

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 01 31 19

PROJECT MEETINGS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Provisions established within the General and Supplementary General Conditions of the Contract, Specifications, and the Drawings are collectively applicable to this Section.

1.2 SECTIONS INCLUDES

- A. Scheduling and administration of progress meetings.
- B. Reinstallation conferences

1.3 RELATED SECTIONS

- A. Section 01 31 13 "Project Coordination."
- B. Section 01 31 19.13 "Preconstruction Meetings."
- C. Section 01 32 13 "Scheduling of Work."
- D. Section 01 33 00 "Submittal Procedures."
- E. Section 01 73 00 "Execution."

1.4 PROGRESS MEETING

- A. The Architect will schedule and administer weekly construction progress meetings, throughout progress of Work as appropriate. It will prepare agenda, and distribute notice of meeting to participants, and distribute minutes within five (5) days after meeting.
- B. The Architect shall make physical arrangements.
- C. The Architect will preside at meetings, record minutes, and distribute copies after meeting to participants, and to entities affected by decisions at meetings.
- D. Location of Meetings: Contractor's field office or at other location as appropriate
- E. Attendance: Contractor, Contractor's HVAC, Electrical, Plumbing, and Structural Steel Subcontractors' Project Managers, job superintendent, subcontractors and suppliers (as appropriate to agenda), Owner, Architect and professional consultants (as appropriate).
- F. Anticipated Agenda: Approval of minutes of previous meeting
  - 1. Review of Work progress and Contractor's daily manpower reports.
  - 2. Field observations, issues, and decisions.
  - 3. Identification of issues which impede planned progress.
  - 4. Review of submittals, schedule and status of submittals.
  - 5. Review of off-site fabrication and delivery schedules.
  - 6. Maintenance of project schedule.
  - 7. Corrective measures to regain projected schedule.
  - 8. Planned progress during succeeding work period.
  - 9. Coordination of projected progress.
  - 10. Maintenance of quality and work standards.
  - 11. Effect of proposed changes on project schedule and coordination.

12. Other business relating to Work.

1.5 PREINSTALLATION CONFERENCES

- A. When required in individual Specification Sections, the Contractor will convene a preinstallation conference at work site prior to commencing work of the Section.
- B. Contractor shall require attendance of entities directly affecting, or affected by, Work of the Section.
- C. Contractor shall notify Architect seven (7) days in advance of meeting date.
- D. Contractor shall prepare agenda, preside at conference, record minutes, and distribute copies within five (5) days after conference to participants, with two (2) copies to the PMF.
- E. Contractor shall review conditions of installation, preparation and installation procedures, and coordination with related work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 31 19

SECTION 01 31 19.13

PRECONSTRUCTION MEETINGS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Provisions established within the General and Supplementary General Conditions of the Contract, Specifications, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

- A. Contractor participation in preconstruction conferences.

1.3 RELATED SECTIONS / DOCUMENTS

- A. Section 01 10 00 "Summary."
- B. Section 01 31 13 "Project Coordination."
- C. Section 01 31 19 "Project Meetings."

1.4 PRECONSTRUCTION CONFERENCE

- A. The Architect shall schedule and conduct the meeting within ten (10) days after Notice to Proceed is issued.
- B. Attendance: Owner, Architect, Contractor and representatives of major Subcontractors.
- C. Agenda (including but not limited to)
  - 1. Review of Contract Documents.
  - 2. Submittal of list of all subcontractors, list of products, schedule of values, and progress schedule.
  - 3. Designation of responsible personnel.
  - 4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal requests, change orders, and Contract close-out procedures.
  - 5. Use of premises by Owner and Contractor.
  - 6. Owner's requirements: Compliance with prevailing wage and affirmative action.
  - 7. Temporary facilities.
  - 8. Safety, security and housekeeping procedures.
  - 9. Schedules.
  - 10. Procedures for testing.
  - 11. Procedures for maintaining Record Documents.
  - 12. Requirements for startup of equipment.
  - 13. Inspection and acceptance of equipment put into service during construction period.
  - 14. Project Close-out requirements.

PART 2 - PRODUCTS (Not Applicable)

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 31 19.13

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  1. Contractor's Construction Schedule.
  2. Submittals Schedule.
  3. Field condition reports.
  4. Critical Path Method (CPM).

1.3 SUBMITTALS

- A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
  1. Scheduled date for first submittal.
  2. Specification Section number and title.
  3. Submittal category (action or informational).
  4. Name of subcontractor.
  5. Description of the Work covered.
  6. Scheduled date for Architect's final release or approval.
- B. Contractor's Construction Schedule: Submit two opaque copies of initial schedule, large enough to show entire schedule for entire construction period.
- C. Critical Path Method (CPM) Reports: Concurrent with CPM schedule, submit three copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days. Failure to submit schedule will result in the holding of payment.
- D. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

## 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
- B. Activities: Treat each building site or separate area as a separately numbered activity for each principal element of the Work. Comply with the following:
  - 1. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  - 2. Submittal Review Time: Include review and resubmittal times.
- C. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

## 2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized, cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
  - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Mobilization and demobilization.
    - b. Fabrication.
    - c. Installation.
    - d. Testing.
  - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
  - 3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
- D. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
  - 1. Contractor or subcontractor and the Work or activity.
  - 2. Description of activity.
  - 3. Principal events of activity.
  - 4. Immediate preceding and succeeding activities.
  - 5. Early and late start dates.
  - 6. Early and late finish dates.
  - 7. Activity duration in workdays.
  - 8. Total float or slack time.

## PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities prior to the construction meeting.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

END OF SECTION 01 32 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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## SECTION 01 32 13

## SCHEDULING OF WORK

## PART 1 – GENERAL

## 1.01 GENERAL REQUIREMENTS

- A. The Work under this Contract will be planned, scheduled, executed and reported pursuant to the provisions of the General Conditions, and the Specified Completion Dates in the Supplementary Conditions.
- B. The services provided by the Architect as the Owner's agent, the existence of schedules, networks, Gantt charts or any other charts or services prepared or performed by the Architect, shall in no way relieve the Contractor of the responsibility of complying with all of the requirements of the Contract Documents, including, but not limited to, the responsibility of completing the Work within the Contract Time and the responsibility of planning, scheduling, and coordinating the Work. The Contractor is required to comply with all control procedures specified herein and with any reasonable changes that may be necessary, in the opinion of the Architect, during the Contract duration.
- C. All milestones or Specific Completion Dates listed in these specifications, or elsewhere in the Contract Documents, represent only the major items of construction/erection work or interface dates. The Completion Dates are considered essential to the satisfactory performance of this Contract and to the coordination of all work on the project.
- D. The Specific Completion Dates listed represent the latest allowable completion dates. Earlier completion dates may be established as agreed by the Contractor and the Architect.
- E. Should the Contractor plan to complete the Work earlier than any required Milestone or Completion date, the Owner or Architect shall not be liable to the Contractor for any costs or other damages if the Contractor is unable to complete the Work before such Milestone or Completion date.
- F. The Contractor shall provide all information and input required for development of the schedule for the work according to the requirements of this Section. The purpose of the project schedule shall be to:
  - a. Assure adequate planning, scheduling and reporting during execution of the contract;
  - b. Assure coordination of the work of the Contractor and the various subcontractors and suppliers;
  - c. Assist the Contractor, Architect, and Owner in monitoring the progress of the work and evaluating proposed changes to the Contract and the project schedule;
  - d. Assist the Contractor, Architect, and Owner in the preparation and evaluation of the Contractor's monthly progress payments;
- G. The Contractor shall involve all applicable Subcontractors in the schedule development, updating, and revisions, as required.
- H. If the Contractor fails to gain approval from the Architect for any schedule requirements required by this project, the general conditions monies in the contract will be held until an updated schedule has been approved.

## 1.02 BREACH

- A. Failure of the Contractor to comply with the requirements of this Section shall constitute reason that the Contractor is failing to prosecute the Work with such diligence as will insure its completion within the Contract items shall be considered a breach of the contract.

## PART 2 - Not Used

## PART 3 - SPECIFIC REQUIREMENTS

### 3.01 GENERAL REQUIREMENTS

- A. The Work under this Contract will be planned, scheduled, executed and reported using the Critical Path Method (after this called CPM).
- B. Provide the Architect with the Daily Manning reports. The reports for the week are due the Monday of the following week.

### 3.02 POST AWARD ACTIVITIES

- A. Network Requirements
  - 1. Within twenty (20) calendar days of the Notice to Proceed, the Contractor shall submit to the Architect for review and comment, a CPM Schedule in precedence form for the construction/erection work scope. The CPM Schedule shall provide a complete and detailed sequence of operations of the Work within the time limits specified in the Contract.  
Prior to the submission of the Contractor CPM schedule and within 14 days of the Notice to Proceed; the Contractor shall facilitate a "Scheduling Work Session" with the Site, Mason, Plumbing, Electrical, HVAC, and Structural Steel subcontractors. Each subcontractor shall provide input to arrive at an integrated Project Construction schedule, which integrates submittals construction activities, durations and sequences to facilitate completion in an orderly manner in conformance with the milestones of the Contract Documents. The work session will be held at the contractor's field office or other location as appropriate with the Architect in attendance (as appropriate).
    - a. The CPM Schedule diagram shall include:
      - 1. The order and interdependencies of the Contractor's activities and the major points of the interface or interrelation with the activities of others, including Specific Dates for completion. The following criteria shall form the basis for assembly of the logic:
        - a. What activity must be completed before a subsequent activity can be started?
        - b. What activities can be done concurrently? This includes activities with Start-To-Start and Finish-To-Finish relationships with or without leads and lags.

- c. What activity must be started immediately following a completed activity?
2. Activities should be linked between major area separations of the project so that the individual areas do not imply complete independence. The critical path should run through all major areas, since the entire project must be completed.
  3. Conformance with and identification of the Specific Dates specified in the Contract Documents.
  4. The description of work by activity.
  5. Off site activities: The Contractor shall include in the CPM Schedule all procurement activities which lead to the delivery of materials to the site. Upon written approval from the Architect, these activities may be submitted as a separate Off-Site Activities Schedule, properly correlated to the CPM Schedule. The Schedule of Off-Site Activities shall include the following:
    - a. Dates for submittals, ordering, manufacturing or fabricating, and delivery of equipment and materials. Long lead items requiring more than one month between ordering and delivery to the site shall be clearly noted;
    - b. All significant Contractor activities during the fabrication and erection/installation in a Contractor's plant or on a job site, including materials/equipment purchasing, and delivery;
    - c. Contractor's drawings and submittals to be prepared and submitted to the Architect.
  6. The Contractor shall be solely responsible for expediting the delivery of all material to be furnished by him so that construction progress is maintained according to the current Schedule for the Work.
  7. Submittals, equipment orders and similar items are to be treated as Schedule activities, and shall be given appropriate activity numbers.
  8. Required delivery dates of Authority-furnished material and equipment.
  9. Shop fabrication and delivery.
  10. Critical Path (or Paths).
  11. Testing of equipment and materials.
- b. The identity, duration and logic of activities comprising the CPM Schedule shall meet the following criteria:
    1. Activity boundaries shall be easily measurable and descriptions shall be clear and concise. Do not preface activity descriptions with "Begin" or "Complete." The beginning and end of each activity shall be readily verifiable, and progress should be quantifiable.
    2. Responsibility for each activity shall be identified with a single performing organization.

3. The cost component for each activity shall be provided. The sum of the activity cost components shall equal the contract price. No costs, however, shall be assigned to manufacture or delivery activities. This list of costs shall be referred to as the Schedule of Values for use in progress payments.
  4. Potential problems or constraints related to the implementation of the construction plan shall be identified in writing.
  5. Seasonal weather conditions, utility coordination, no-work periods, expected job learning curves, and other foreseeable delays to activities shall be considered and included in the planning and scheduling of all work.
  6. Maximize Start-To-Start and Finish-To-Finish activity relationships. Overlapping activities minimizes out-of-sequence problems that arise when most relationships are Finish-To-Start with zero lead or lag.
  7. Imposed completion dates for events other than the Specified Completion Dates will not be permitted.
2. The level of detail of the CPM Schedule shall be such that activity durations over twenty-one (21) calendar days shall be kept to a minimum except for non-construction activities such as shop drawing and sample submittals, fabrication and delivery of materials and equipment, delivery of equipment, concrete curing, and General Conditions activities, or with the approval of the Architect.
  3. The CPM Schedule shall show an early completion date for the project that is not later than the project's required completion date. All activity durations shall be given in working days. The CPM Schedule also shall show the following for each activity:
    - a. Interfaces with the work of outside contractors, e.g., utilities, power, and with any separate contractor.
    - b. Description.
    - c. Estimated duration.
    - d. Early start (by calendar date).
    - e. Late start (by calendar date).
    - f. Early finish (by calendar date).
    - g. Late finish date (by calendar date).
    - h. Total float available in work days.
    - i. Actual start date (by calendar date).
    - j. Actual finish date (by calendar date).
    - k. Activity codes (s).
    - l. The Critical Path for the project, with said path of activities being clearly and easily recognizable on the time-scaled CPM Schedule Diagram. The relationship between all non-critical activities and activities on the Critical Path shall be clearly shown on the CPM Schedule Diagram.
    - m. The dollar value of each activity (Schedule of Values).
    - n. The responsibility code for the Contractor or Subcontractor performing each activity or portion of the activity.
    - o. The percentage complete of each activity in progress or completed whether manually input or computer calculated.

4. It is to be expressly understood and agreed by the Contractor that the Schedule is an estimate to be revised from time to time as progress proceeds, and that the Owner does not guarantee that the Contractor can start work activities on the "early start" or "late start" dates or complete work activities on the "early finish" or "late finish" date shown in the initial Schedule, or in an updated or revised Schedule; nor does the Owner or Architect guarantee that Contractor can always proceed in the sequence established by said Schedule. If Contractor's Schedule shows that the Owner or a separate contractor is to complete an activity by a specific date, or within a certain duration, Owner or any separate contractor under contract with Owner shall not be bound to said date or duration unless Owner expressly and specifically agrees in writing to same; the Owner's and/or the Architect's review and approval or acceptance of the Schedule does not constitute an agreement to specific dates, durations, or sequences for activities of the Owner or any separate contractor.
5. Required Submittals. The submittal of the contract scheduling documents shall include:
  - a. A plotter-generated time-scaled network diagram showing activity descriptions, durations and relationships between activities. The critical path should be easily identifiable.
  - b. The following reports: 1) three (3) sorts of the standard CPM report, including, as a minimum, activity numbers, descriptions, early and late start and finish dates, and total float; the report shall be sorted by Activity Number, Early Start, and Total Float; 2) predecessor/successor report, showing the above information plus the predecessors and successors for each activity.
  - c. A computer disk CD containing the schedule data files. The Contractor shall develop the schedule using the Primavera scheduling system or an equivalent system. The Primavera system is preferred. The Architect has the right to accept or reject requests by the Contractor to use a scheduling system other than Primavera.

B. Approval Process

1. The Architect will review the Contractor's Schedule, including logic diagrams and computer-generated analysis. The Contractor shall comply with all of the submission requirements of the scheduling specification as set forth in the Section above entitled "Submittals." If the Contractor submits a complete package that complies with the requirements, the Architect shall have seven (7) calendar days to review and comment in writing.
2. The Contractor shall revise and resubmit the Schedule as soon as practical but in all cases within fourteen (14) calendar days. The Architect will have five (5) calendar days to review and comment on the revised Schedule.
3. Within seven (7) calendar days following acceptance of the Schedule, the Contractor shall provide one (1) copies of the CPM Schedule with Computer Reports to the Architect for final review and acceptance. The Architect will have the final review and acceptance within three (3) working days.
4. Upon approval, the Schedule will become the official Project Schedule and will be used to monitor progress of the Work, subject to such revisions made to the Schedule as provided for herein or in the Contract Documents, and to support requests for payment.
5. If the Contractor thereafter wishes to make changes in its method of operating and

scheduling, he shall follow the procedures set out in Paragraph 3.08, Network Revisions, of this Section.

6. Acceptance by the Owner/Architect of the Contractor's CPM Schedule shall not relieve the Contractor of the responsibility for accomplishing the Work within every Contract-required Milestone and Completion date. The Owner and Owner's Representative disclaims any obligation or liability due to acceptance of the CPM Schedule.
7. If the Contractor fails to provide the schedules within the time prescribed, or revisions to the schedule within the requested time, the Owner may withhold approval of payment until the Contractor submits the required information.

### 3.03 COMPUTER COST AND SCHEDULE REPORTS

- A. Every month the Contractor will generate Computer Cost and Schedule Reports from the CPM Schedule Network, based on the progress of the work. These computer reports will reflect the progress of the project with respect to both cost and time. The Contractor will generate these reports for the information and use of the Owner in reviewing and monitoring progress.

### 3.04 SCHEDULE UPDATES

- A. The Contractor understands and agrees that their schedule is intended to accurately reflect at all times the status of the Project construction. The Contractor also understands and agrees that updating the schedule is a key component of this requirement and will make every reasonable effort to provide current information.
- B. Separate update meetings will be held to report schedule progress and to review the Contractor's Application for Progress Payment. The Application for Progress Payment is produced by the Contractor based on the Schedule of Values of the cost-loaded CPM. In each case, the previous month's CPM reports will be used to record progress. The Contractor understands and agrees that updating the schedule is independent from updating the cost for progress payment purposes.
- C. The progress report submitted by the Contractor will indicate, as a minimum, those activities, or portions of activities, which were completed during the reporting period, the actual start and finish dates for those activities, remaining duration and/or estimated completion dates for activities currently in progress.
- D. The Architect and the Owner will not be obligated to review or to process any Application for Progress Payment until the Contractor has submitted a progress report and the percentages of completion are agreed to by the Architect and the Contractor.
- E. Throughout the progress of the Work, the Contractor shall prepare and maintain a three week manual bar chart field schedule reflecting the schedule of work activities accomplished for the previous week and the work scheduled for the forthcoming two weeks. This manual field schedule shall be updated weekly.
- F. When updating the computerized schedule, the Contractor must use the option that retains the logic. Primavera calls this option "Retained Logic." Any option that overrides the logic and allows activities that have started out-of-sequence to float to the project end date is not permitted. Since other scheduling systems may have different features for handling out-of-sequence activities, the Architect will evaluate the options and notify the Contractor in writing which option is acceptable.
- G. Specific dates for schedule updates shall be agreed and established by the Architect and Owner, but shall be, at a minimum, monthly.

### 3.05 CONTRACTOR'S ORGANIZATION

- A. The Contractor shall maintain, as part of its organization, a staff of sufficient size knowledgeable in the use and application of CPM. The Contractor's staff will be responsible for preparing the CPM Schedule, monitoring progress, updating and revising logic diagrams when necessary.

### 3.06 RECOVERY SCHEDULE

- A. Should any of the conditions exist, such that certain activities shown on the Contractor's CPM Schedule fall behind schedule to the extent that any of the Specific Dates are in jeopardy, the Contractor shall be required, at no extra cost to the Owner, to prepare and submit to the Architect, in addition to the Project Schedule, a supplementary Recovery Schedule, in a form and detail appropriate to the need, to explain and display how he intends to reschedule those activities to regain compliance with the CPM Schedule during the immediate subsequent pay period. The preparation of a recovery schedule shall not be grounds for a Change Order or a Time Extension.
- B. The Contractor shall do the following, after determination of the requirement for a Recovery Schedule:
  - 1. Within three (3) calendar days, the Contractor shall submit a Recovery Schedule for acceptance to the Architect. The Recovery Schedule shall be prepared to similar level of detail as the CPM Schedule and shall have a maximum duration of one (1) month.
  - 2. Any revisions necessary because of this review shall be resubmitted by the Contractor for acceptance within two (2) calendar days of the conference. The approved Recovery Schedule shall then be the Schedule that the Contractor shall use in planning, organizing, directing, coordinating, performing and executing the Work (including all activities of subcontractors, equipment vendors and suppliers) for its one (1) month duration, to regain compliance with the CPM Schedule.

### 3.08 NETWORK REVISIONS

- A. The Contractor understands and agrees that their schedule is intended to accurately reflect at all times the status of the Project construction. The Contractor also understands and agrees that changes or revisions to the schedule are key components of this requirement and will make every reasonable effort to provide information as quickly as possible so that the CPM schedule accurately reflects current conditions.
- B. Should the Contractor, after approval of the initial CPM Schedule want to change the plan of construction, he shall submit the requested revisions to the Architect including a description of the logic for rescheduling the work, methods of maintaining adherence to intermediate milestones and specific dates and the reasons for the revisions. The Architect will have five (5) working days to review and either approve the change or reject the change in writing to the Contractor. If the requested changes are approved by the Architect they will be incorporated by the Contractor into the CPM Schedule in the next reporting period.
- C. The Contractor shall revise the schedule to include the effect of changes, acts of God or other conditions or events that have affected the CPM Schedule. The Architect will have seven (7) calendar days to review and either approve the change or reject the change

in writing to the Contractor. If the requested changes are approved by the Architect they will be incorporated by the Contractor into the CPM Schedule in the next reporting period.

- D. When the Owner orders changes by Change Order that have the potential to impact the Contract Milestones or Specific Dates stipulated, a Network will be prepared by the Contractor and provided to the Architect. After the Owner accepts the Network, it will be incorporated into the CPM Schedule by the Contractor.
- E. Neither the updating or revision of Contractor's Detailed Project Schedule nor the submission, updating, change or revision of any report or schedule for Owner's review or non-objection of any such report or schedule shall have the effect of amending or modifying, in any way, the Contract Time, any Contract Completion Date, or contract milestone Dates or of modifying or limiting in any way Contractor's obligations under this Contract.
- F. If at any time during the construction, it appears to the Architect that the Contractor's schedule no longer represents the actual prosecution and progress of the work, the Architect will request in writing a revision to the schedule. Any "out of sequence progress" problems will be considered evidence that the schedule needs revising. The Contractor then has three (3) working days to respond to that written request. In the event the contractor does not agree with the conclusion of the Architect regarding the schedule status of the project, it shall be resolved in accordance with the disputes clause of the contract.
- G. Failure to furnish any required submittal or information specified herein shall constitute a cause for withholding any part of progress payments pursuant to the General Conditions.

### 3.09 COORDINATION

- A. The Contractor shall coordinate the work with that of the other contractors and shall cooperate fully with the Architect in maintaining orderly progress toward completion of the Work as scheduled.
- B. Failure of Owner-furnished equipment and materials to arrive as scheduled, or failure of other construction contracts to meet their schedule, shall not be justification for an extension of time, except where such failure causes, in the opinion of the Architect, an unreasonable delay in the Contractor's work, in which case the provisions of the General Conditions regarding extensions of time shall apply.
- C. The Contractor shall keep himself/herself, and subcontractors, advised always while the Work is progressing regarding delivery status of Owner-furnished equipment and material and of the progress of construction work being performed under separate contracts.
- D. The Contractor shall involve all applicable Subcontractors in the schedule development, updating, and revisions, if required.

END OF SECTION 01 32 13



SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including but not limited to, General and Supplementary Conditions and other Division 1 Specification Sections, apply to Work of this Section.

1.2 SUMMARY

- A. As evidence of existing conditions, work progress, and Substantial Completion, the Contractor shall furnish the Owner, through the Architect, photographs of the Work in the quantities set forth in Section 01 10 00 "Summary." Each photograph shall be noted with the date and time the picture was taken, the name of the project, description of photograph and directional identification, e.g., "looking north". The photographs shall be taken from locations approved by the Architect.

PART 2 — PRODUCTS (Not Applicable)

PART 3 — EXECUTION (Not Applicable)

END OF SECTION 01 32 33

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittal procedures.
- B. Proposed products list.
- C. Product data.
- D. Shop drawings.
- E. Samples.
- F. Design data.
- G. Test reports.
- H. Certificates.
- I. Manufacturer's instructions.
- J. Manufacturer's field reports.

1.2 SUBMITTAL PROCEDURES

- A. The Contractor shall provide a submittal log no later than (20) twenty days after the Notice to Proceed for Architect approval. The Log shall list all proposed submittals and submission dates. The Contractor shall keep a running log of all submittals. That log shall have the submittal date, name, return date and action.
- B. Transmit each submittal with Architect accepted form.
- C. Submit number of copies Contractor requires, plus three copies Architect will retain.
- D. Provide a copy of transmittal to Architect.
- E. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- F. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.
- G. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- H. Schedule submittals to expedite Project, and deliver to Architect at business address. Coordinate submission of related items.
- I. For each submittal for review, allow 10 days excluding delivery time to and from Contractor.
- J. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.
- K. Allow space on submittals for Contractor and Architect review stamps.
- L. When revised for resubmission, identify changes made since previous submission.
- M. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- N. Submittals not requested will not be recognized or processed.

### 1.3 PROPOSED PRODUCTS LIST

- A. Within 5 days after date of Owner-Contractor Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

### 1.4 PRODUCT DATA

- A. Product Data: Submit to Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Submit number of copies Contractor requires, plus three copies Architect will retain.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00.

### 1.5 SHOP DRAWINGS

- A. Shop Drawings: Submit to Architect newly prepared information, drawn to accurate scale, for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Do not reproduce Contract Documents or copy standard information as the basis for Shop Drawings. Shop Drawings which reproduce the Contract Documents or copy standard information will be returned to the Contractor without Architect review.
- C. Shop Drawings shall include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Indicate dimensions, identification of products and material included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurements, special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Submit number of opaque reproductions Contractor requires, plus three copies Architect will retain.
- E. Do not use Shop Drawings without a review stamp from Architect indicating action taken in connection with construction.
- F. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00.

### 1.6 SAMPLES

- A. Samples: Submit to Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Samples For Selection as Specified in Product Sections:
  - 1. Submit to Architect for aesthetic, color, or finish selection.
  - 2. Submit samples of finishes from full range of manufacturers' standard colors, or in custom colors selected, textures, and patterns for Architect selection.

- C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- D. Include identification on each sample, with full Project information.
- E. Submit number of samples specified in individual specification sections; Architect will retain two samples.
- F. Reviewed samples that may be used in the Work are indicated in individual specification sections.
- G. Samples will not be used for testing purposes unless specifically stated in specification section.
- H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 70 00.

#### 1.7 DESIGN DATA

- A. Submit for Architect knowledge as contract administrator or for Owner.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

#### 1.8 TEST REPORTS

- A. Submit for Architect knowledge as contract administrator or for Owner.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

#### 1.9 CERTIFICATES

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

#### 1.10 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect for delivery to Owner in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

#### 1.11 MANUFACTURER'S FIELD REPORTS

- A. Submit reports for Architect's benefit as contract administrator or for Owner.
- B. Submit report in duplicate within 3 days of observation to Architect for information.
- C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

PART 2 PRODUCTS (Not Used).

PART 3 EXECUTION (Not Used).

END OF SECTION 01 33 00

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of this Contract, indicating but not limited to, General and Supplementary Conditions and other Division 1, Specification Sections, apply to the work of this Section.

1.2 DESCRIPTION OF REQUIREMENTS

- A. This Section specifies administrative and procedural requirements for temporary services and facilities, including such items as temporary utility services, temporary construction and support facilities, and project security and protection.
- B. Use Charges: No cost or usage charges for temporary services or facilities are chargeable to the Owner or Architect. Cost or use charges for temporary services or facilities will not be accepted as a basis of claims for a Change Order extra.
- C. Temporary utilities services required for use at the project site include but are not limited to the following:
  - 1. Water service.
  - 2. Temporary electric power and light.
  - 3. Telephone service.
  - 4. Adequate utility capacity at each stage of construction.
  - 5. Prior to availability of temporary utilities at the site, trucked-in services for start-up of construction operations.
- D. Temporary construction and support facilities required for the Project include but are not limited to the following:
  - 1. Temporary ventilation.
  - 2. Field offices and storage sheds.
  - 3. Sanitary facilities, including drinking water.
  - 4. Dewatering facilities and drains,
  - 5. Temporary protection of existing property.
  - 6. Site enclosure fence.
  - 7. First aid station.
  - 8. Project identification, bulletin boards and signs.
  - 9. Waste disposal services.
  - 10. Rodent and pest control.
  - 11. Construction aids and miscellaneous general services and facilities.
  - 12. Alternate temporary services and facilities, equivalent to those specified, may be used, subject to acceptance by the Architect.
- E. Security and protection facilities and services required for Project include but are not limited to the following:
  - 1. Temporary fire protection.
  - 2. Barricades, warning signs, lights.

3. Sidewalk bridge or enclosure fence for the site.
4. Environmental protection / erosion control.
5. Alternate security and protection methods or facilities, equivalent to those specified, may be used, subject to acceptance by the Architect.
6. Overhead protection.

### 1.3 SUBMITTALS

- A. Reports and Permit: During progress of the Work, submit copies of reports and permits required by governing authorities or necessary for installation and efficient operation of temporary services and facilities.
- B. Shop Drawings: Submit shop drawing of project identification sign as indicated later in this section.

### 1.4 QUALITY ASSURANCE

- A. Regulations: Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities, including but not limited to the following:
  1. Building Codes, including requirements for permits, testing, and inspection.
  2. Health and safety regulations.
  3. Utility company regulations and recommendations governing temporary utility services.
  4. Police and Fire Department rules and recommendations.
  5. Police and Rescue Squad recommendations.
  6. Environmental protection regulations governing use of water and energy, and the control of dust, noise and other nuisances.
- B. In addition, comply with "Environmental Impact" commitments the Owner, the State, or the District have made to secure approval to proceed with construction of the Project.
- C. Standards: Comply with the requirements of NFPA Code 241, "Building Construction and Demolition Operations", the ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and the NECA National Joint Guideline NJG-6 "Temporary Job Utilities and Services".
- D. Inspections: Inspect and test each service before placing temporary utilities in use. Arrange for required inspections and tests by governing authorities, and obtain required certifications, and permits for use.

### 1.5 JOB CONDITIONS

- A. General: Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in performance of the Work. Maintain, expand as required and modify temporary services or facilities as needed throughout the progress of the Work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.
- B. Conditions of Use: Operate temporary services and facilities in a safe and efficient manner. Do not overload temporary services of facilities, and do not permit them to interfere with the progress of the Work. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.
- C. Temporary Utilities: Do not permit the freezing of pipes, flooding or the contamination of water sources.



- D. Security and Protection: Maintain site security and protection facilities in a safe, lawful and publicly acceptable manner. Take necessary measures to prevent erosion of the site.

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

- A. General: Provide new materials and equipment for temporary services and facilities; used materials and equipment that are undamaged and in serviceable condition may be used, if acceptable to the Architect. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.
- B. Temporary Construction and Support Facilities: Provide facilities that can be maintained properly throughout their use at the Project site.
- C. Chain-Link Fencing: Minimum 2" (50-mm), 0.148" (3.76-mm) thick, galvanized steel, chain-link fabric fencing; minimum 6'-0" (1.8 m) high with galvanized steel pipe posts; minimum 2 $\frac{3}{8}$ " (60-mm) OD line posts and 2 $\frac{7}{8}$ " (73-mm) OD corner and pull posts, with 1 $\frac{5}{8}$ " (42-mm) OD top rails.
- D. Field Offices: Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.
- E. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
  - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- F. Self-Contained Toilet Units: Provide single-occupant self-contained toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar non-absorbent material. Provide one for every 30 employees.
- G. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
  - 1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55°F (7.2 to 12.7°C).
- H. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- I. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. General: Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire Project adequately and result in minimum interference with the performance of the Work.
  - 1. Relocate, modify and extend services and facilities as required during the course of Work

so as to accommodate the entire Work of the Project.

- B. Temporary Telephones:
  1. General: Arrange for the local telephone company to install temporary service to the Project.

### 3.2 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. General: Provide a reasonably neat and uniform appearance in temporary construction and support facilities acceptable to the Architect.
- B. Field Offices: Provide temporary field offices of sufficient size to accommodate required office personnel and meetings at the project site.
- C. Sanitary Facilities: Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for type, number, location, operation, and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations that will best serve the Project's needs.
- D. Dewatering Facilities and Drains: Dispose of rainwater subsurface water or other fluids in a lawful manner, which will not result in flooding the Project or adjoining property, nor endanger either permanent work or temporary facilities. Control and suitably dispose of water and other fluids by means of temporary pumps, piping drainage lines or other methods.
  1. Provide temporary drainage where the roofing or similar waterproof deck construction is completed prior to the connection and operation of the permanent drainage piping system; provide temporary drainage.
- E. Temporary Heating and Cooling for Construction: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
- F. Ventilation and Humidity Control for Construction: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.

Where; temporary wood or plywood enclosure exceeds 100 square feet in area, use UL-labeled fire-retardant treated material for framing and main sheathing.

All temporary work shall be designed and installed so that the work can be conveniently erected without building-in any of the temporary work. Temporary work shall be changed, rebuilt, and adjusted as needed to suit the conditions of the work and the work of subcontractors. Such temporary work shall be removed from the project by the Contractor on or before completion of the work when no longer required.

The Contractor shall provide and hang temporary doors and shall construct temporary

enclosures so that the entire project may be secured from the exterior by locks and keys as soon as possible. He shall keep and maintain such temporary doors and temporary enclosures in good order and repair. He shall provide keys for the use of the Architect. These requirements shall include all other door openings to streets, roofs, driveways, and other places until they are secured with permanent construction.

Should the glazing of exterior windows not be performed at such times and in such order as is required to fully protect the building against the elements, the Contractor shall furnish and set, for the window openings, substantial temporary enclosures. Such temporary enclosures shall be firmly secured and maintained at all times in good, proper and sound condition, sufficient to protect the building from damage and surfaces from staining.

Roof openings shall be temporarily and adequately covered and kept water-tight by the General Contractor until permanent construction at such openings has been installed.

Whenever weather conditions require or whenever directed, the Contractor shall provide tarpaulin curtains, coverings, windbreaks, and other protection to exposed masonry during the construction of exterior walls.

- J. Temporary protection of existing property: The Contractor is responsible for protecting all spaces and objects within, and adjacent to, the area of work where construction could damage the existing conditions, including, but not limited to, finishes, furniture, fixtures, computers and other equipment within, and adjacent to, the areas of work, and those areas that could be affected by the work.

Due diligence includes verifying all conditions of adjacent spaces that could be affected by the work. Contractor shall be responsible for documenting the existing conditions and shall bring to the attention of the Architect any existing damage prior to the start of the work. If necessary, Contractor shall provide photographic documentation of existing damage.

Before demolition, contractor is responsible to take all necessary precautions to protect finishes, furniture, fixtures, computers and other equipment with plastic or other appropriate protective covers throughout the duration of the project. Protection to be included in the bid.

Contractor shall provide interior supervision during demolitions and installation of the work and all other construction activities as Contractor deems appropriate.

Contractor is responsible for cleaning all spaces affected by debris & dust from construction including but not limited to all interior spaces in which dust & debris has fallen. Contractor to remove all large debris caused from construction of the project, even from spaces where such debris would be hidden from view. Contractor will be responsible to repair and bring to like-new condition, or provide new, all items damaged due to the construction of the work.

- K. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
- L. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- M. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.

1. Provide one 100-W incandescent lamp per 500 sq. ft. (45 sq. m), uniformly distributed, for general lighting, or equivalent illumination.
  2. Provide one 100-W incandescent lamp every 50 feet (15 m) in traffic areas.
  3. Provide one 100-W incandescent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.
  4. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
- N. Project Identification and Temporary Signs: Prepare project identification and other temporary signs of the size and with content indicated.
1. Project Identification Signs: Fabricate project identification sign from 8'-0" wide by 4'-0" high by ¾" thick medium density overlaid (MDO) plywood panel, **B-B** APA. Include names of: (1) Project, (2) Architect, (3) Contractor and (4) District. Mount sign in location as directed by Architect using 4"x4" wood posts in earth. Engage an experienced sign painter to paint graphics. Messages and colors shall be approved by the Owner.
- O. Temporary Site Safety and Directional Signs: Prepare signs in sizes required for legibility or as indicated. Install signs where required or indicated to inform public and persons seeking entrance to Project. Provide a sign at each site.
1. Prepare temporary signs to provide directional information to construction personnel and visitors.
  2. Construct signs of exterior-type Grade B-B plywood in sizes and thicknesses indicated or required. Support on posts or framing of preservative-treated wood or steel, or attach to fencing; do not attach signs to buildings or permanent construction.
  3. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer. Engage an experienced sign painter or fabricator to apply graphics; hand paint sign.
  4. Include relocating temporary site safety and directional signs as many times as required or directed.
- P. Collection and Disposal of Wastes: Establish a system for daily collection and disposal of waste materials from construction areas and elsewhere on the site. Enforce requirements strictly. Do not hold collected materials at the site longer than seven (7) days during normal weather or three (3) days when the daily temperature is expected to rise above 80°F (27°C). Handle waste materials that are hazardous, dangerous, or unsanitary separately from other inert waste by containerizing appropriately. Dispose of waste material in a lawful manner.
- Q. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- R. Site Enclosure Fence: Before construction operations begin, install chain-link enclosure fence with lockable entrance gates. Locate where indicated, to enclose a portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
1. Set fence posts in concrete bases.
  2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
  3. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Architect with one set of keys.

- S. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- T. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

### 3.3 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary services and facilities at the site. Limit availability of temporary services and facilities to essential and intended uses to minimize waste and abuse. Do not permit temporary installations to be abused or endangered. Do not allow hazardous, dangerous or unsanitary conditions to develop or persist on the Project site.
- B. Maintenance: Operate and maintain temporary services and facilities in good condition throughout the time of use and until removal is authorized.
- C. Termination and Removal: Unless the Architect requests that it be maintained for a longer period of time, remove each temporary service and facility promptly when the need for it or a substantial portion of it has ended, or when it has been replaced by the permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent work which may have been delayed because of interference with the temporary service or facility. Repair damaged work, clean exposed surfaces and replace work which cannot be satisfactory repaired.

END OF SECTION 01 50 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 01 57 29

TEMPORARY INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Construction Indoor Air Quality (IAQ) Management Plan.
  - 2. HVAC air filters.
- B. Related Sections:
  - 1. Section 01 81 13 "Sustainable Design Requirements:" General requirements.

1.2 REFERENCES

- A. American Society of Heating, Refrigerating & Air Conditioning Engineers (ASHRAE):
  - 1. ASHRAE 52.2 - Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size.
- B. Sheet Metal and Air Conditioning National Contractors Association (SMACNA):
  - 1. SMACNA IAQ 2nd Edition 2007 - Guideline for Occupied Buildings under Construction, Chapter 3: Control Measures.
- C. U.S. Environmental Protection Agency (EPA):
  - 1. EPA IAQ Testing - Compendium of Methods for the Determination of Air Pollutants in Indoor Air.
- D. U.S. Green Building Council (USGBC):
  - 1. LEED Reference Guide - LEED for Building Design and Construction, Version 3.

1.3 PLAN REQUIREMENTS

- A. Develop and implement Construction IAQ Management Plan according to SMACNA IAQ as approved by Architect for compliance with the following:
  - 1. USGBC LEED Credit EQ 3.1; During Construction
- B. Intent:
  - 1. Prevent indoor air quality problems resulting from construction and renovation process.
  - 2. Protect HVAC system during construction and renovation, control pollutant sources, and interrupt contamination pathways.

1.4 SUBMITTALS

- A. Product Data: Submit description and performance data for filters including MERV ratings.
- B. Construction IAQ Management Plan: Submit plan describing methods and procedures for implementing and monitoring compliance as specified in this Section.

## 1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents:
  - 1. Submit construction photographs showing compliance with Construction IAQ Management Plan.
  - 2. Certify that five design approaches of SMACNA IAQ were used during building construction and provide description of design approaches employed.

## 1.6 CONSTRUCTION IAQ MANAGEMENT PLAN

- A. Implement Construction IAQ Management Plan at start of construction.
- B. Review Construction IAQ Management Plan at preconstruction meeting and progress meetings specified.
- C. Distribute approved Construction IAQ Management Plan to Subcontractors and others affected by plan requirements.
- D. Oversee plan implementation, instruct construction personnel about plan compliance, and document plan results.
- E. Address the following requirements in Construction IAQ Management Plan:
  - 1. Meeting or exceeding design approaches of SMACNA IAQ.
  - 2. Permitting adequate airing-out of new materials.
  - 3. Proper curing of concrete before covering.
  - 4. Avoiding building occupancy while construction-related pollutants are present.
  - 5. Smoking inside building.
  - 6. Dust control.
  - 7. Debris removal.

## 1.7 SEQUENCING

- A. Sequence material delivery and installation to avoid exposing insulation, carpeting, acoustical ceilings, gypsum board, and other absorptive materials to contamination and moisture.
  - 1. Enclose building before storing and installing moisture-sensitive products within building under construction.

## PART 2 PRODUCTS

### 2.1 HVAC AIR FILTERS

- A. Return Filters: Filtration media rated for minimum efficiency reporting value (MERV) when tested according to ASHRAE 52.2.
  - 1. Construction Return Filters: MERV of 8.
  - 2. Flush-Out Return Filters: MERV of 13.
  - 3. Permanent Filters: As specified.
- B. Supply Filters: As specified.



## PART 3 EXECUTION

### 3.1 FILTER INSTALLATION AND REPLACEMENT

- A. Install construction return filter at each return grille before operating permanent air handlers during construction.
- B. Replace filters after completing construction and before occupancy.
  - 1. Replace construction return filters with permanent filters.
  - 2. Replace supply filters.

### 3.2 CONSTRUCTION PHOTOGRAPHS

- A. Photograph construction operations to show compliance with SMACNA IAQ and Construction IAQ Management Plan.
  - 1. Take minimum of six photographs on minimum of three different occasions during construction to show consistent adherence with specified requirements.
  - 2. Identify photographs as required and identify SMACNA IAQ approach illustrated in each photograph.

END OF SECTION 01 57 29

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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## SECTION 01 60 00

## PRODUCT REQUIREMENTS

## PART 1- GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawing and General Provisions of Contract, including but not limited to, General and supplementary Conditions and other Division 1, Specification Sections, apply to work of this Section.

## 1.2 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.
- B. Approval: All substitutions must be approved by Design Consultant.
- C. Asbestos in Materials: All products submitted for use and incorporated into this project shall be asbestos free.
- D. Mechanical Materials and Equipment: When two or more items of same material or equipment are required (pumps, valves, air conditioning units, etc.), they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in the work, except as otherwise indicated. Provide products which are compatible within systems and other connected items.
- E. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
  - 1. The contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

## 1.3 SUBMITTALS

- A. Product Listing Submittal
  - 1. General: Prepare a product-listing schedule in a form acceptable to the Architect. Show names of the principal products required for the Work, by generic name. Show proprietary product names and the name of the manufacturer for each item listed that is to be purchased and incorporated into the Work.
  - 2. Form: Prepare the product-listing schedule with information on each item tabulated under the following scheduled column headings:
    - a. Generic name as used in Contract Documents.
    - b. Proprietary name, model number and similar product designation.
    - c. Manufacturer's and supplier's name and city/state addresses.
    - d. Related unit-of-work Specification Section number
    - e. Manufacturer's Data.
    - f. Performance and test data.
    - g. Reference Standard.

3. Submittal: With bid, submit two (2) copies to Architect of complete list of all products and materials which are proposed for installation if different than the basis of design. Products substituted after bid will not be considered.
- B. Architect's Action: The Architect will respond to the Contractor in writing within two (2) week of receipt of the product-listing schedule. No response by the Architect within the two (2) week time period constitutes no objection to the listed products or manufacturers, but does not constitute a waiver of the requirement that products comply with the requirement of the Contract Documents. All substitutions must be acceptable to the Architect. The Architect's response will include the following:
1. A request for additional data necessary for the review and possible acceptance of the products and manufacturer's listed.
- C. Substitution Request Submittal
1. Requests for Substitutions: Submit five (5) copies of each request for substitution. In each request identify the product or fabrication or installation method to be replaced by the substitution; include related Specification Section and Drawing numbers, and complete documentation for substitutions. Include the following information, as appropriate, with each request.
    - a. Provide complete product data, drawings and descriptions of products, and fabrication and installation procedures.
    - b. Provide samples where applicable or requests.
    - c. Provide complete cost information, including a proposal of the net change, if any in the Contract Price.
    - d. Provide certification by the Contractor to the effect that, in the Contractor's opinion, after thorough evaluation, the proposed substitution will result in work that in every significant respect is equal-to or better than the work required by the Contract Documents, and that Include in this certification, the Contractor's waiver of rights to additional payment or time, which may subsequently be necessary because of the failure of the substitution to perform adequately.
    - e. Substitution Request Form: Submit requests for substitution in the form acceptable to the Architect.
    - f. Architect's Action: Within one (1) week of receipt of Contractor's request for substitution, the Design Consultant will request additional information or documentation as may be needed for evaluation of the request. Within two (2) weeks of receipt of the request, or within one (1) week of receipt of the requested additional information or documentation, which ever is later, the Design Consultant will notify the Contractor of either the acceptance or rejection of the proposed substitution.
    - g. Substitution must carry equal or better warranty to the product specified.
    - h. Acceptance will be in the form of an Acceptance of Bid. Rejection will include a statement giving reason for rejection.

#### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss including theft. Control delivery schedule to minimize long-term storage at the site and to prevent overcrowding of construction spaces. In particular coordinate delivery and storage times for items known or recognized to be

flammable, hazardous, easily damaged or sensitive to deterioration, theft and other source of loss.

## PART 2 - PRODUCTS

### 2.1 GENERAL PRODUCTS COMPLIANCE

- A. Procedures for Selecting Products: The Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects. Required procedures include but are not limited to the following for the various indicated methods of specifying.
- B. Two or More Product Names: Where two or more products or manufacturers are named, provide one of the products named, at the Contractor's option. Exclude products that do not offer to provide an unnamed product, unless the Specification indicates possible consideration of other products. Advise the Architect before proceeding where none of the named products comply with Specification requirements, or are feasible for use.
  - 1. Where products or manufacturers are specified by name, accompanied by the term "or-equal" or similar language, comply with the Contract document provisions concerning "substitutions" to obtain approval from the Design Consultant for the use of an unnamed product.
- C. Compliance with Standards, Codes and Regulations: Where the Specifications require only compliance with an imposed standard, code or regulations, the Contractor has the option of selecting a product that complies with Specification requirements, including the standards, codes and regulations.
- D. A named product and model number establishes the characteristics and salient features of the specifications even when they are not fully described.

### 2.2 SUBSTITUTIONS

- A. Conditions: The Contractor's request for a substitution will be received and considered when extensive revisions to the Contract Documents are not required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the requests are timely, fully documented and properly submitted, and when one or more of the following conditions is satisfied, all as judged by the Architect; otherwise the requests will be returned without action except to record non-compliance with these requirements.
  - 1. The Architect will consider a request for substitution where the request is directly related to an "or equal" clause or similar language in the Contract Documents.
- B. Work-Related Submittals: The Contractor's submittal of and the Architect's acceptance of shop drawings, product data or samples which relate to work not complying with requirements of the Contract Documents, does not constitute an acceptance or valid request for a substitution, nor approval thereof.

### 2.3 GENERAL PRODUCT REQUIREMENTS

- A. General: Provide products that comply with the requirements of the Contract Documents and that are undamaged and, unless otherwise indicated, unused at the time

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

of installation. Provide products that are complete with all other devices and details needed for a complete installation and for the intended use and effect.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 60 00

SECTION 01 66 00

PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Provisions established within the General and Supplementary Conditions of the Contract, Specifications, and Drawings are collectively applicable to this Section.

1.2 REQUIREMENTS INCLUDED

- A. Storage, General.
- B. Enclosed Storage.
- C. Exterior Storage.
- D. Maintenance Storage.

1.3 RELATED REQUIREMENTS

- A. Section 01 10 00 "Summary."
- B. Section 01 50 00 "Temporary Facilities and Controls."
- C. Section 01 70 00 "Execution and Closeout Requirements."

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 STORAGE, GENERAL

- A. Store products, immediately on delivery, in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.
- B. Arrange storage in a manner to provide access for maintenance of stored items and for inspection.

3.2 ENCLOSED STORAGE

- A. Store products, subject to damage by the elements, in substantial weather tight enclosures.
- B. Maintain temperature and humidity within ranges stated in manufacturer's instructions.
- C. Provide humidity control and ventilation for sensitive products as required by manufacturer's instructions.
- D. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

3.3 EXTERIOR

- A. Provide substantial platforms, blocking, or skids, to support fabricated products above

- ground; slope to provide drainage. Protect products from soiling and staining.
- B. For products subject to discoloration or deterioration from exposure to elements, cover with impervious sheet material. Provide ventilation to avoid condensation.
- C. Store granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.
- D. Provide surface drainage to prevent erosion and ponding of water.
- E. Prevent mixing of refuse or chemically injurious materials or liquid.

### 3.4 MAINTENANCE OF STORAGE

- A. Periodically inspect stored products on a scheduled basis.
- B. Verify that storage facilities comply with manufacturer's product storage requirements.
- C. Verify that manufacturer's required environmental conditions are maintained continually.
- D. Verify that surfaces of products exposed to the elements are not adversely affected; that any weathering of finishes is acceptable under requirements of Contract Documents.

### 3.5 MAINTENANCE OF EQUIPMENT STORAGE

- A. For mechanical and electrical equipment in long-term storage, provide manufacturer's service package.
- B. Service equipment on a regularly scheduled basis, maintaining a log of services; submit as a Record Document.

END OF SECTION 01 66 00



SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.
- B. Related Requirements:
  - 1. Section 01 33 00 "Submittal Procedures" for submitting surveys.
  - 2. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 PREINSTALLATION REVIEW

- A. Cutting and Patching Planning: Contractor is responsible for establishing appropriate means and methods for accomplishing the Work. Conduct sufficient investigation of existing conditions at the Project site to understand the building's structure, materials, finishes, and building systems that may be affected. Plan cutting operations to minimize the nature of resulting patching as much as possible.
  - 1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Require representatives of each entity directly concerned with cutting and patching to participate in review, including the following:
    - a. Contractor's superintendent.

- b. Trade supervisor responsible for cutting operations.
  - c. Trade supervisor(s) responsible for patching of each type of substrate.
  - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affecting by cutting and patching operations.
2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For any land surveyor, professional engineer, or other consultant whose services are required by the nature of the project.
- B. Certificates: In the case of confirming building or component locations by a licensed surveyor, submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal. Submittal of such receipts is a required delivery by the Contractor for the Owner's permanent record on the Project.
- D. Final Property Survey: Where alteration of existing or creation of new site construction, utility systems, or building footprint changes are involved, submit five (5) copies signed by land surveyor showing the Work performed and record survey data.

#### 1.6 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
  2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    - a. Primary operational systems and equipment.
    - b. Fire separation assemblies.
    - c. Air or smoke barriers.
    - d. Fire-suppression systems.
    - e. Plumbing piping systems.
    - f. Mechanical systems piping and ducts.
    - g. Control systems.
    - h. Communication systems.
    - i. Fire-detection and -alarm systems.
    - j. Conveying systems.
    - k. Electrical wiring systems.
    - l. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
    - a. Water, moisture, or vapor barriers.
    - b. Membranes and flashings.
    - c. Exterior curtain-wall construction.
    - d. Sprayed fire-resistive material.
    - e. Equipment supports.
    - f. Piping, ductwork, vessels, and equipment.
    - g. Noise- and vibration-control elements and systems.
  4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
  1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.
- C. The Contractor, including their Subcontractors, is prohibited for using, furnishing, or installing any Asbestos Containing Material (ACM) for this project.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services; and other utilities. Confirm that existing constraints are valid for the planned Work, before proceeding.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
  2. List of detrimental conditions, including substrates.
  3. List of unacceptable installation tolerances.
  4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Contractor is responsible for final fit and finish of the installed Work. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings. Submitted shop drawings and any layout information are to be based on data that has been verified in the field (VIF).
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a Request for Interpretation (RFI) to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks, and for interior construction or alteration, in relation to constraining dimensions. If discrepancies are discovered, notify Architect promptly requesting review of the discovered situation using the procedure for submitting RFI's.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish limits on use of Project site.
  - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 4. Inform installers of lines and levels to which they must comply.
  - 5. Check the location, level and plumb, of every major element as the Work progresses.
  - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
  - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: If included in the Project, locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

### 3.4 FIELD ENGINEERING

- A. Identification: For Projects involving site work or new construction, the Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.

3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
  1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
  2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
  4. Maintain minimum headroom clearance of 96" (2440 mm) in occupied spaces and 90" (2300 mm) in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  2. Allow for building movement, including thermal expansion and contraction.
  3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with

integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
  - 1. Comply with Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective Work.

### 3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent or at least minimize interruption to occupied areas. Any unavoidable interruption must be coordinated with Owner at least 72 hours in advance of such activity. The default condition for service or system interruptions shall be that they can only occur in an unoccupied status, on Premium time.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.

- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.7 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### 3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.



1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80°F (27°C).
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- 3.9 STARTING AND ADJUSTING
- A. Perform startup and adjusting of equipment and operating components in compliance with manufacturer's instructions and recommendations.
  - B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
  - C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
  - D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- D. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- E. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
  - 1. Section 02 41 19.13 "Selective Building Demolition" for demolition of selected portions of the building.
  - 2. Divisions 02 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Extent: Describe cutting and patching related to structural work and utilities; show how they will be performed.
  - 2. Dates: Indicate when cutting and patching will be performed.
  - 3. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
  - 4. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
  - 1. Primary operational systems and equipment.
  - 2. Fire-suppression systems.
  - 3. Mechanical systems piping and ducts.
  - 4. Control systems.
  - 5. Communication systems.
  - 6. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

## 1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
  - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

### 3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 5. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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 administrative and procedural requirements for the following:
  - 1. Disposing of nonhazardous demolition and construction waste.
- B. Related Sections include the following:
  - 1. Section 02 41 19.13 "Selective Building Demolition" for disposition of waste resulting from partial demolition of buildings.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

END OF SECTION 01 74 19



SECTION 01 77 00  
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.
- B. Related Requirements:
  - 1. Section 01 20 00 "Price and Payment Procedures" for requirements concerning Applications for Payment at Substantial and Final Completion.
  - 2. Section 01 32 33 "Photographic Documentation" for submitting final completion construction photographic documentation.
  - 3. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
  - 4. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at final completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

## 1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, Final Completion construction photographs with corresponding digital electronic .jpg files, and similar final record information.
  3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number, where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
  5. Submit testing, adjusting, and balancing records. Obtain reports on startup testing of systems, and deliver copies to Owner for their permanent record of all documentation and reports regarding such initial testing.
  6. Submit sustainable design submittals not previously submitted, when these are listed as a project requirement.
  7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List any items below that are still incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Coordinate final changeover of permanent locks, and deliver any keys being provided by the Contractor to the Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment, with reports of results.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings for their continued use.
  6. Advise Owner of changeover in utility services.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements.
  10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.

#### 1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 01 20 00 "Price and Payment Procedures."
  2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report and warranty.
  5. Submit any final completion photographic documentation not already submitted at Substantial Completion.
  6. Resolve any open questions coming from executed Owner training sessions.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and be ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, and where appropriate, starting with exterior areas first and proceeding from lowest floor to highest floor.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
  - a. Project name.
  - b. Date.
  - c. Name of Architect.
  - d. Name of Contractor.
  - e. Page number.
4. Submit list of incomplete items in the following format:
  - a. MS Excel electronic file. Architect will return annotated file. Or use below.
  - b. PDF electronic file. Architect will return annotated file.

#### 1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  1. Submit on digital media acceptable to Architect.
- E. Warranties in Paper Form:
  1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½" x 11" (215mm x 280mm) paper.
  2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor. If permitted by Owner, paper warranties may be bound into O&M Manual binders and clearly marked for easy access as noted in paragraph below.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - d. Remove snow and ice, if encountered, to provide safe access to building.
    - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - g. Sweep concrete floors broom clean in unoccupied spaces.
    - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - j. Remove labels that are not permanent.
    - k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    - m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    - n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    - p. Leave Project clean and ready for occupancy.

- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."
  - 1. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
  - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Emergency manuals.
  - 2. Operation manuals for systems, subsystems, and equipment.
  - 3. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems, and equipment.

1.3 SUBMITTALS

- A. Final Submittal: Submit one copy of each manual in final form before final inspection. Architect will return copy with comments after final inspection.
  - 1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
  - 1. Name and address of Project.
  - 2. Date of submittal.
  - 3. Name, address, and telephone number of Contractor.
  - 4. Name and address of Architect.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8½" x 11" paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
  2. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
  3. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.2 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
  2. Flood.
  3. Gas leak.
  4. Water leak.
  5. Power failure.
  6. Water outage.
  7. System, subsystem, or equipment failure.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
  2. Shutdown instructions for each type of emergency.
  3. Operating instructions for conditions outside normal operating limits.
  4. Required sequences for electric or electronic systems.
  5. Special operating instructions and procedures.

## 2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
  2. Operating procedures.



3. Wiring diagrams.
4. Control diagrams.
5. Piped system diagrams.
6. Precautions against improper use.
7. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Operating characteristics.
5. Limiting conditions.
6. Performance curves.
7. Engineering data and tests.
8. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. Schedule for routine cleaning and maintenance.
4. Repair instructions.

- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

### PART 3 - EXECUTION

#### 3.1 MANUAL PREPARATION

- A. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

END OF SECTION 01 78 23

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
- B. Related Sections include the following:
  - 1. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set of marked-up Record Prints.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.
  - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
  - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
    - a. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
  - 2. Content: Types of items requiring marking include, but are not limited to, the following:

- a. Dimensional changes to Drawings.
  - b. Revisions to details shown on Drawings.
  - c. Depths of foundations below first floor.
  - d. Locations and depths of underground utilities.
  - e. Revisions to electrical circuitry.
  - f. Actual equipment locations.
  - g. Duct size and routing.
  - h. Changes made by Change Order or Construction Change Directive.
  - i. Changes made following Architect's written orders.
3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect.
    - e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

## 2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

## PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 02 41 19.13

SELECTIVE BUILDING DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Demolishing designated building equipment and fixtures.
  - 2. Demolishing designated construction.
  - 3. Cutting and alterations for completion of the Work.
  - 4. Removing designated items for re-use and Owner's retention.
  - 5. Protecting items designated to remain.
  - 6. Removing demolished materials.

1.2 SUBMITTALS

- A. Section 01 33 00 "Submittal Procedures:" Requirements for submittals.
- B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.
- C. Shop Drawings:
  - 1. Indicate demolition and removal sequence.
  - 2. Indicate location of items designated for reuse and Owner's retention.
  - 3. Indicate location and construction of temporary work.

1.3 CLOSEOUT SUBMITTALS

- A. Section 01 77 00 "Closeout Procedures:" Requirements for submittals.
- B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, and subsurface obstructions.
- C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.4 QUALITY ASSURANCE

- A. Conform to applicable code for demolition work, dust control, and products requiring electrical disconnection and re-connection.
- B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.
- C. Obtain required permits from authorities having jurisdiction.
- D. Perform Work in accordance with State of New Jersey Public Work's standard.
- E. Maintain one copy of each document on site.

1.5 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 "Administrative Requirements:" Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

## 1.6 SEQUENCING

- A. Section 01 10 00 “Summary:” Requirements for sequencing.
- B. Owner will conduct salvage operations before demolition begins to remove materials Owner chooses to retain.

## 1.7 SCHEDULING

- A. Section 01 32 13 “Scheduling of Work:” Requirements for scheduling.
- B. Schedule Work to coincide with new construction.
- C. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation and in adjoining spaces.
- D. Coordinate utility and building service interruptions with Owner.
  - 1. Do not disable or disrupt building fire or life safety systems without three days prior written notice to Owner.
  - 2. Schedule tie-ins to existing systems to minimize disruption.
  - 3. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

## 1.8 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Architect. Do not resume operations until directed.

## PART 2 - PRODUCTS (Not Used.)

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Notify affected utility companies before starting work and comply with their requirements.
- B. Mark location and termination of utilities.
- C. Erect, and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public, Owner, and existing improvements indicated to remain.
- D. Layout cuts in post tensioned concrete elements to avoid cutting concrete within 12” of any stressing tendon.
- E. Erect and maintain weatherproof closures for exterior openings.
- F. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.
- G. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.
- H. Provide appropriate temporary signage including signage for exit or building egress.
- I. Do not close or obstruct building egress path.



- J. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

### 3.2 SALVAGE REQUIREMENTS

- A. Coordinate with Owner to identify building components and equipment required to be removed and delivered to Owner.
- B. Tag components and equipment Owner designates for salvage.
- C. Protect designated salvage items from demolition operations until items can be removed.
- D. Carefully remove building components and equipment indicated to be salvaged.
- E. Disassemble as required to permit removal from building.
- F. Package small and loose parts to avoid loss.
- G. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.
- H. Prepare assembly instructions consistent with disassembled parts. Package assembly instructions in protective envelope and securely attach to each disassembled salvaged item.
- I. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

### 3.3 DEMOLITION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Maintain protected egress from and access to adjacent existing buildings at all times.
- C. Do not close or obstruct sidewalks without permits.
- D. Cease operations immediately when structure appears to be in danger and notify Architect.
- E. Disconnect and remove designated utilities within demolition areas.
- F. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.
- G. Demolish in orderly and careful manner. Protect existing improvements and supporting structural members.
- H. Carefully remove building components indicated to be reused.
  - 1. Disassemble components as required to permit removal.
  - 2. Package small and loose parts to avoid loss.
  - 3. Mark components and packaged parts to permit reinstallation.
  - 4. Store components, protected from construction operations, until reinstalled.
- I. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- J. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- K. Remove temporary Work.

END OF SECTION 02 41 19.13

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 03 54 16

HYDRAULIC CEMENT UNDERLAYMENT

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. Polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

1.3 ALLOWANCES

- A. Provide hydraulic cement underlayment as part of base bid.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Hydraulic cement underlayment.
  - 2. Reinforcement.
  - 3. Primer.
  - 4. Corrosion-resistant coating.
  - 5. Surface sealer.
  - 6. Sound control mat.
- B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Test Reports:
  - 1. For fire-resistant ratings, from a qualified testing agency.
  - 2. For STC-rated assemblies, from a qualified testing agency.
  - 3. For IIC-rated assemblies, from a qualified testing agency.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

## 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
  - 1. Place hydraulic cement underlayment only when ambient temperature and temperature of substrates are between 50°F and 80°F.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Comply with ASTM E119; 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.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. IIC-Rated Assemblies: For IIC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E492 and classified according to ASTM E989 by an independent testing agency.

### 2.2 HYDRAULIC CEMENT UNDERLAYMENTS

- A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of ¼" and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150/C150M, Portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C219.
  - 2. Compressive Strength: Not less than **4000 psi** at 28 days when tested according to ASTM C109/C109M.
  - 3. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Aggregate: Well-graded, washed gravel, ⅝" to ¼"; or coarse sand as recommended by underlayment manufacturer.
  - 1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70°F.
- D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.
- E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
- F. Corrosion-Resistant Coating: Recommended in writing by underlayment manufacturer for metal substrates.

- G. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

### 2.3 ACCESSORIES

- A. Sound Control Mat: As required to meet STC and IIC ratings, manufactured by gypsum cement underlayment manufacturer.
  - 1. Thickness: TBD

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare and clean substrate according to manufacturer's written instructions.
  - 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
  - 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
  - 1. Moisture Testing: Perform tests so that each test area does not exceed **200 sq. ft.**, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test, ASTM F1869: Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of **3 lb of water/1000 sq. ft.** in 24 hours.
    - b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum **85%** relative humidity level measurement, or as recommended by hydraulic cement underlayment manufacturer.
- C. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.
  - 1. Install underlayment reinforcement recommended in writing by manufacturer.
- D. Metal Substrates: Mechanically remove, according to manufacturer's written instructions, rust, foreign matter, and other contaminants that might impair underlayment bond. Apply corrosion-resistant coating compatible with underlayment if recommended in writing by underlayment manufacturer.
- E. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.

- F. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.
- G. Sound Control: Install sound control materials according to manufacturer's written instructions.
  - 1. Do not install mechanical fasteners that penetrate through the sound control materials.

### 3.3 INSTALLATION

- A. Mix and install underlayment components according to manufacturer's written instructions.
  - 1. Close areas to traffic during underlayment installation and for time period after installation recommended in writing by manufacturer.
  - 2. Coordinate installation of components to provide optimum adhesion to substrate and between coats.
  - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Install underlayment to produce uniform, level surface.
  - 1. Install a final layer without aggregate to product surface.
  - 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during installation and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Apply surface sealer at rate recommended by manufacturer.
- G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

### 3.4 INSTALLATION TOLERANCES

- A. Finish and measure surface, so gap at any point between gypsum cement underlayment surface and an unleveled, freestanding, 10'-0" long straightedge resting on two high spots and placed anywhere on the surface does not exceed **1/4" and 1/16" in 2'-0"**.

### 3.5 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 54 16

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed-steel stud interior wall framing.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry:" Wood sheathing.
2. Section 06 10 53 "Miscellaneous Rough Carpentry:" Rough wood blocking.
3. Section 09 21 16 "Gypsum Board Assemblies:" Lightweight, non-load-bearing metal stud framing.

1.2 REFERENCE STANDARDS

A. American Iron and Steel Institute:

1. AISI S213: North American Standard for Cold-Formed Steel Framing - Lateral Design.
2. AISI S214: North American Standard for Cold-Formed Steel Framing - Truss Design.
3. AISI General - Standard for Cold-Formed Steel Framing - General Provisions.
4. AISI Header - Standard for Cold-Formed Steel Framing - Header Design.
5. AISI NAS - North American Specification for the Design of Cold-Formed Steel Structural Members.
6. AISI PM - Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings.
7. AISI WSD - Standard for Cold-Formed Steel Framing - Wall Stud Design.

B. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.
2. AWS D1.3 - Structural Welding Code - Sheet Steel.

C. ASTM International:

1. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
2. ASTM A1003 - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
3. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

D. California Department of Health Services:

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

E. Green Seal:

1. GC-03- 2nd Edition, January 7, 1997 - Anti-Corrosive Paints.
- F. National Association of Architectural Metal Manufacturers:
1. NAAMM ML/SFA 540 - Lightweight Steel Framing Systems Manual.
- G. SSPC: The Society for Protective Coatings:
1. SSPC Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
  2. SSPC Paint 20 - Zinc-Rich Coating (Type I - Inorganic and Type II - Organic).
- H. Steel Stud Manufacturers Association:
1. SSMA - Product Technical Guide.
- 1.3 COORDINATION
- A. Section 01 30 00 "Administrative Requirements:" Requirements for coordination.
- 1.4 SUBMITTALS
- A. Section 01 33 00 "Submittal Procedures:" Requirements for submittals.
- B. Shop Drawings:
1. Indicate component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related Work.
  2. Indicate stud, floor joist, ceiling joist, roof joist, roof rafter, and roof truss layout.
  3. Describe method for securing studs to tracks and for bolted framing connections.
- C. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Mill Certifications: Submit mill certifications for steel delivered to Site. Certify steel bare metal thickness of 1 mil, yield strength, tensile strength, total elongation in 2" or 8"-gauge length, chemical analysis, and galvanized coating thickness.
- F. Welders' Certificates: Certify welders and welding procedures employed on the Work, verifying AWS qualification within previous 12 months.
- G. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for loadings and stresses of specially fabricated framing.
- H. Qualifications Statements:
1. Submit qualifications for manufacturer, installer, and licensed professional.
  2. Submit manufacturer's approval of installer.
- 1.5 SUSTAINABLE DESIGN SUBMITTALS
- A. Section 01 81 13 "Sustainable Design Requirements:" Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
1. Materials Resources Certificates:
    - a. Certify source and origin for salvaged and reused products.
    - b. Certify recycled material content for recycled content products.
    - c. Certify source for regional materials and distance from Project Site.
  2. Indoor Air Quality Certificates:



- a. Certify volatile organic compound content for each interior paint and coating.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
1. Provide cost data for the following products:
    - a. Salvaged, refurbished, and reused products.
    - b. Products with recycled material content.
    - c. Regional products.

## 1.6 QUALITY ASSURANCE

- A. Calculate structural properties of framing members according to AISI NAS.
- B. Furnish framing materials according to SSMA - Product Technical Guide.
- C. Perform Work according to following:
  1. Framing: AISI General and AISI NAS.
  2. Headers: AISI Header.
  3. Trusses: AISI S214.
  4. Wall Studs: AISI WSD.
  5. Lateral Design: AISI S213.
  6. Residential Framing: AISI PM.
- D. Form, fabricate, provide, and connect components according to NAAMM ML/SFA 540 - Lightweight Steel Framing Systems Manual.
- E. Maintain one copy of each standard affecting the Work of this Section on-Site.

## 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.
- C. Welders and Welding Procedures: AWS D.1 qualified within previous 12 months for employed weld types.
- D. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of New Jersey.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Size components to withstand design loads as follows:
  1. Vertical Assembly: 30 psf positive and 30 psf negative.
  2. Horizontal Assembly: 30 psf live loads.
- B. Maximum Allowable Deflection: 1:720 of span.
- C. Wall System:
  1. Design to AISI NAS, AISC General, and AISC Header.

2. Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
3. Design system to accommodate:
  - a. Construction tolerances, deflection of building structural members, and clearances of intended openings.
  - b. Expansion and contraction of members and building movement without damage to connections or members.
4. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated according to code.

D. Select stud thickness to resist minimum 5 psf uniform load and maximum 1/360 deflection.

## 2.2 COLD-FORMED METAL FRAMING

### A. Manufacturers:

1. Marino/Ware
2. Dale/Incor
3. Superior Steel Studs
4. U.S. Gypsum Co.
5. Substitutions: Specified in Section 01 60 00 "Product Requirements."

B. Description: ASTM C955.

## 2.3 FRAMING MATERIALS

### A. Steel Sheet:

1. ASTM A1003.
2. Structural grade, Type H, metallic coated.
3. Grade: As required by performance requirements.
4. Coating: G60.

### B. Studs:

1. Steel sheet, formed to channel shape, punched web, knurled faces.
2. Size: As shown on Drawings.

### C. Track:

1. Steel sheet, formed to channel shape.
2. Width: Same as studs, tight fit.
3. Thickness: As shown on Drawings.
4. Type: Solid web.

## 2.4 FASTENERS

- A. Self-Drilling, Self-Tapping Screws and Bolts, Nuts, and Washers: Steel, hot-dip galvanized.
- B. Anchorage Devices: Power-actuated, drilled expansion bolts, and screws with sleeves.
- C. Welding: According to AWS D1.1 and AWS D1.3.

## 2.5 FABRICATION

- A. Fabricate assemblies of formed sections of required sizes and profiles.
- B. Fit, reinforce, and brace framing members to suit design requirements.
- C. Fit and assemble in largest practical sections for delivery to Site, ready for installation.

## 2.6 FINISHES

- A. Shop Primer: SSPC Paint 15, Type 1, red oxide.
- B. Touchup Primer: Match shop primer.

## 2.7 ACCESSORIES

- A. Bracing, Furring, and Bridging: Formed sheet steel, thickness determined by performance requirements specified.
- B. Plates, Gussets, and Clips: Formed sheet steel, thickness determined by specified performance requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 01 70 00 "Closeout Requirements:" Requirements for installation examination.
- B. Verify that substrate surfaces and/or building framing components are ready to receive Work.
- C. Verify that rough-in utilities are in proper location.

### 3.2 ERECTION

- A. Studs:
  - 1. Align floor and ceiling tracks and locate to wall layout.
  - 2. Secure in place with fasteners at maximum 24" o.c.
  - 3. Coordinate installation of acoustic sealant with floor and ceiling tracks.
  - 4. Place studs at 16" o.c., not more than 2 inches from abutting walls, and at each side of openings.
  - 5. Connect studs to tracks using clip-and-tie or fastener method.
  - 6. Construct corners using minimum of three studs.
  - 7. Double-stud wall openings, door jambs, and window jambs.
  - 8. Erect load-bearing studs one piece, full length; splicing of studs not permitted.
  - 9. Erect load-bearing studs, brace, and reinforce to achieve design requirements.
  - 10. Fully seat axial-loaded studs in receiving tracks at maximum 1/16" gap between stud and track web.
  - 11. Coordinate placement of insulation in multiple stud spaces after erection.
  - 12. Install intermediate studs above and below openings to align with wall stud spacing.
  - 13. Install studs with deflection allowance in stud track, directly below horizontal building framing at non-load-bearing framing.
  - 14. Attach furring channels to studs for attachment of fixtures anchored to walls.
  - 15. Install framing between studs for attachment of mechanical and electrical items and to prevent stud rotation.
  - 16. Touch up field welds and damaged primed surfaces with primer to match shop coating.

3.3 TOLERANCES

- A. Section 01 40 00 "Quality Requirements:" Requirements for tolerances.
- B. Maximum Variation from Indicated Position:  $\frac{1}{2}$ ".
- C. Maximum Variation of Members from Plane:  $\frac{1}{2}$ ".

END OF SECTION 05 40 00

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Structural floor, wall, and roof framing.
  2. Floor, wall, and roof sheathing.
  3. Preservative treatment of wood.
  4. Fire-retardant treatment of wood.
  5. Miscellaneous framing and sheathing.
  6. Telephone and electrical panel back boards.
  7. Concealed wood blocking for support of toilet and bath accessories and wall cabinets.
- B. Related Requirements:
1. Section 08 51 13 "Aluminum Windows:" openings to receive wood blocking.

1.2 REFERENCE STANDARDS

- A. American National Standards Institute / American Hardboard Association:
1. ANSI/AHA A135.4 - Basic Hardboard.
- B. American Wood Protection Association:
1. AWPAC M4 - Standard for the Care of Preservative-Treated Wood Products.
  2. AWPAC U1 - Use Category System: User Specification for Treated Wood.
- C. APA - The Engineered Wood Association:
1. APA - Plywood Design Specification, including supplements.
  2. APA AFG-01 - Adhesives for Field-Gluing Plywood to Wood Framing.
  3. APA PS 1 - Voluntary Product Standard - Structural Plywood.
- D. ASTM International:
1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  2. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
  3. ASTM C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  4. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
  5. ASTM C1396 - Standard Specification for Gypsum Board.
  6. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions.
  7. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems.

8. ASTM D5456 - Standard Specification for Evaluation of Structural Composite Lumber Products.
  9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  10. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
  11. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- E. California Department of Health Care Services:
1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.
- F. Forest Stewardship Council:
1. FSC Guidelines.
- G. Green Seal:
1. GS-36 - Green Seal Standard for Adhesives for Commercial Use.
- H. National Lumber Grades Authority:
1. NLGA - Standard Grading Rules for Canadian Lumber.
- I. Northeastern Lumber Manufacturers Association:
1. NELMA - Standard Grading Rules for Northeastern Lumber.
- J. Redwood Inspection Service:
1. RIS - Standard Specifications for Grades of California Redwood Lumber.
- K. South Coast Air Quality Management District:
1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.
- L. Southern Pine Inspection Bureau:
1. SPIB - Standard Grading Rules for Southern Pine Lumber.
- M. U.S. Department of Commerce National Institute of Standards and Technology:
1. DOC PS 1 - Structural Plywood.
  2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
  3. DOC PS 20 - American Softwood Lumber Standard.
- N. West Coast Lumber Inspection Bureau:
1. WCLIB Standard 17 - Grading Rules for West Coast Lumber.
- O. Western Wood Products Association:
1. WWPA - Western Lumber Grading Rules.
- 1.3 COORDINATION
- A. Section 01 30 00 "Administrative Requirements:" Requirements for coordination.
  - B. Coordinate curb installation with installation of decking and support of deck openings and new rooftop equipment.

#### 1.4 SUBMITTALS

- A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
- B. Product Data: Submit manufacturer information on insulated sheathing, wood preservative materials, and application instructions.

#### 1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 “Sustainable Design Requirements:” Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify that following products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for regional materials and distance from Project Site.
    - c. Certify that lumber is harvested from Forest Stewardship Council Certified well-managed forest.
  - 2. Indoor Air Quality Certificates:
    - a. Certify VOC content for each interior adhesive and sealant and related primer.
    - b. Certify each composite wood product contains no added urea formaldehyde resins.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work according to:
  - 1. Lumber Grading Agency: Certified by DOC PS 20.
  - 2. Wood Structural Panel Grading Agency: Certified by APA - The Engineered Wood Association.
  - 3. Lumber: DOC PS 20.
  - 4. Wood Structural Panels: DOC PS 1 or PS 2.
- B. Fire-Rated Wall Construction:
  - 1. Rating: As indicated on Drawings.
  - 2. Tested Rating: Determined according to ASTM E119.
  - 3. Prescriptive Rating:
    - a. Determined according to applicable code.
- C. Surface-Burning Characteristics:
  - 1. Fire-Retardant-Treated Materials: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.
- D. Apply label from agency approved by authority having jurisdiction to identify each preservative-treated and fire-retardant-treated material.
- E. Maintain one copy of each standard affecting Work of this Section on Site.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

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

- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
  - 1. Provide additional protection according to manufacturer instructions.

## PART 2 - PRODUCTS

### 2.1 FIREBLOCKING AND DRAFTSTOPPING

- A. Fireblocking:
  - 1. Solid Lumber:
    - a. Nominal Thickness: 2".
- B. Draftstopping:
  - 1. Gypsum Board: ½" thick.

### 2.2 MATERIALS

- A. Sheathing:
  - 1. Wood Structural Panel Floor Sheathing:
    - a. Description: APA-rated, single floor.
    - b. Material: plywood.
    - c. Exposure Durability: 1.
    - d. Facing: Unsanded.

### 2.3 SHEATHING AND UNDERLAYMENT LOCATIONS

- A. Floor Sheathing:
  - 1. Thickness: ¾" thick.
  - 2. Sheet Size: 48" x 96".
  - 3. Edges: Tongue-and-groove.
  - 4. Preservative treated.

### 2.4 ACCESSORIES

- A. Fasteners and Anchors:
  - 1. Fasteners:
    - a. High-Humidity and Treated Wood Locations: ASTM A153, hot-dip galvanized steel.
    - b. Elsewhere: Unfinished steel.
  - 2. Nails and Staples: Comply with ASTM F1667.

## PART 3 - EXECUTION

### 3.1 APPLICATION



- A. Sheathing:
  - 1. Subfloor Sheathing:
    - a. Secure subfloor sheathing with longer edge perpendicular to floor framing, with end joints staggered and sheet ends over bearing.
  
- B. Fireblocking and Draftstopping:
  - 1. Install fireblocking to cut off concealed draft openings.
  - 2. Concealed Framed Wall and Furred Spaces: Install fireblocking vertically at floor and ceiling levels and horizontally at maximum 10'-0" o.c.
  - 3. Install fireblocking between:
    - a. Vertical walls and partitions.
    - b. Horizontal floor and roof framing.
    - c. Soffits, dropped ceilings, cove ceilings, and other horizontal concealed spaces.
    - d. Stair Stringers: Furnish at top and bottom of each rung.
  - 4. Exterior Combustible Architectural Trim: Install fireblocking at maximum 20'-0" o.c.
  - 5. Install draftstopping in floors and attics at locations indicated on Drawings.
  
- C. Site-Applied Wood Treatment:
  - 1. Brush-apply one coat of preservative treatment on wood in contact with cementitious materials and roofing and related metal flashings.

END OF SECTION 06 10 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Roof curbs, cants, and perimeter nailers.
  2. Blocking in wall and roof openings.
  3. Wood furring and grounds.
  4. Concealed wood blocking for support of toilet and bath accessories, wall cabinets, and wood trim.
  5. Telephone and electrical panel backboards.
  6. Preservative treatment of wood.

1.2 REFERENCE STANDARDS

- A. American National Standards Institute:
1. ANSI A208.1 - Mat-Formed Wood Particleboard.
- B. American Wood Protection Association:
1. AWWPA M4 - Standard for the Care of Preservative-Treated Wood Products.
  2. AWWPA U1 - Use Category System: User Specification for Treated Wood.
- C. ASTM International:
1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  2. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
  3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  4. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- D. California Department of Health Services:
1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.
- E. Forest Stewardship Council:
1. FSC Guidelines - Forest Stewardship Council Guidelines.
- F. The Redwood Inspection Service:
1. RIS - Standard Specifications for Grades of California Redwood Lumber.
- G. Southern Pine Inspection Bureau:
1. SPIB - Standard Grading Rules for Southern Pine Lumber.

- H. U.S. Department of Commerce National Institute of Standards and Technology:
  - 1. DOC PS 1 - Construction and Industrial Plywood.
  - 2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
  - 3. DOC PS 20 - American Softwood Lumber Standard.
- I. West Coast Lumber Inspection Bureau:
  - 1. WCLIB - Standard Grading Rules for West Coast Lumber.
- J. Western Wood Products Association:
  - 1. WWPA 2011 Western Lumber Grade Rules, including supplements.

### 1.3 SUBMITTALS

- A. Section 01 33 00 "Submittal Procedures:" Requirements for submittals.
- B. Product Data: Submit technical data and application instructions on wood-preservative and fire-retardant treatment materials.

### 1.4 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 "Sustainable Design Requirements:" Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify that the following products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify source for regional materials and distance from Project Site.
    - b. Certify lumber is harvested from Forest Stewardship Council Certified well-managed forest.
  - 2. Indoor Air Quality Certificates:
    - a. Certify each composite wood product contains no added urea formaldehyde resins.

### 1.5 QUALITY ASSURANCE

- A. Perform Work according to following:
  - 1. Lumber Grading Agency: Certified by DOC PS 20.
  - 2. Wood Structural Panel Grading Agency: Certified by APA - The Engineered Wood Association.
  - 3. Lumber: DOC PS 20.
  - 4. Wood Structural Panels: DOC PS 1 or DOC PS 2.
- B. Surface-Burning Characteristics:
  - 1. Fire-Retardant-Treated Materials: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.
- C. Apply label from agency approved by authority having jurisdiction to identify each preservative-treated and fire-retardant-treated material.
- D. Maintain one copy of each standard affecting the Work of this Section on-Site.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Lumber Grading Rules: RIS, SPIB, WCLIB, WWPA G-5].
- B. Miscellaneous Framing: Stress Group A or D; 19% maximum moisture content after treatment.
- C. Plywood: APA-rated sheathing, Grade C-D; Exposure Durability 1; unsanded.

### 2.2 FACTORY WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): AWWPA U1 using waterborne preservative.
- B. Wood Preservative (Surface Application): Clear type.
- C. Fire-Retardant Treatment: Chemically treated and pressure impregnated, having flame spread of 25 or less when tested according to ASTM E 84 and showing no evidence of significant progressive combustion when test is continued for an additional 20-minute period, interior type.
- D. Moisture Content after Treatment: Kiln dried (KDAT).
  - 1. Lumber: Maximum 19%.
  - 2. Structural Panels: Maximum 15%.

### 2.3 ACCESSORIES

- A. Fasteners and Anchors:
  - 1. Fasteners: ASTM A153, hot-dip galvanized steel for high-humidity and treated wood locations, unfinished steel elsewhere.
  - 2. Nails and Staples: ASTM F1667.
  - 3. Anchors: Toggle bolt type for anchorage to hollow masonry, Expansion shield and lag bolt type for anchorage to solid masonry or concrete, Bolt or ballistic fastener for anchorages to steel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 01 73 00 "Execution:" Requirements for installation examination.
- B. Verify that substrate conditions are ready to receive blocking, curbing, and framing.

### 3.2 PREPARATION

- A. Section 01 77 00 "Closeout Procedures:" Requirements for installation preparation.
- B. Coordinate placement of blocking, curbing, and framing items.

### 3.3 INSTALLATION

- A. Set members level and plumb, in correct position.
- B. Place horizontal members, crown side up.
- C. Construct curb members of solid wood sections.
- D. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.
- E. Coordinate curb installation with installation of equipment.

- F. Space framing and furring 16" o.c.
- G. Secure sheathing to framing members with ends over firm bearing and staggered.
- H. Install telephone and electrical panel backboards with plywood sheathing material where required. Size backboards 12" beyond size of electrical and telephone panel.

#### 3.4 SITE-APPLIED WOOD TREATMENT

- A. Brush-apply one coat of preservative treatment on wood in contact with cementitious material, or roofing and related metal flashings.
- B. Treat Site-sawn cuts. Apply preservative to Site-sawn cuts according to AWWA M4.
- C. Allow preservative to dry prior to erecting members.

#### 3.5 ATTACHMENTS

- A. Roof Blocking: Spruce, pine, or fir species; 19% maximum moisture content; pressure-preservative treatment.
- B. Telephone and Electrical Panel Boards: 3/4" thick, square edges, site-brush-applied preservative treated.

END OF SECTION 06 10 53

SECTION 06 41 00

ARCHITECTURAL WOOD CASEWORK

PART 1 – GENERAL

1.1 SUMMARY

- A. Related Documents:
  - 1. Drawings and provisions of the contract including General Conditions Supplementary Conditions and Division 1, apply to this section.
  
- B. Section Includes:
  - 1. Furnish and install plastic laminate casework and accessories as shown and listed on drawings and specified herein. Includes all countertops, sink cutouts, splashes, supports, shelving, and filler panels necessary for a complete casework installation.
  
- C. Related Requirements to be Performed by Others:
  - 1. Section 06 10 00 “Rough Carpentry” for blocking within walls to adequately support casework.
  - 2. Section 07 92 00 “Preformed Joint Sealants” for caulking of casework and/or countertops to abutting walls.
  - 3. Division 09 Section: “Resilient Base and Accessories” for resilient base applied to manufactured casework.
  - 4. Division 22 Section: “Plumbing” for furnishing, installation, and hook-up of sinks, fixtures, outlets, strainers, tailpieces, traps, vacuum breakers, and stops shall be performed by the plumbing contractor to state and local codes. In all cases, sink cutouts shall be by the casework contractor.
  - 5. Division 26 Section: “Electrical” for the electrical contractor to state and local codes shall perform electrical furnishing, installation, and final connections of wiring, conduit, and/or electrical items within casework.

1.2 REFERENCES

- A. ANSI-A135: for all hardboard.
- B. ANSI-A161.2-1998: for performance of fabricated high-pressure decorative laminate countertops.
- C. ANSI-A208.1-2009: for grade M-3 mat-formed wood particleboard.
- D. BHMA A156.9: for grade-1 hinge requirements.
- E. NEMA 3 LD-2005: for performance requirements of high pressure laminates.
- F. SEFA 8PL Recommended Practices: for cabinet construction.

1.3 DEFINITIONS

- A. Exposed:
  - 1. In casework, surfaces visible when drawers and opaque doors (if any) are closed; bottoms of cabinets 42" or more above finished floor; and tops of cabinets less than 78" above finished floor.

- B. Semi-Exposed:
  - 1. In casework, surfaces that become visible when opaque doors are open or drawers are extended; bottoms of cabinets more than 30" or tops of cabinets less than 42" above finished floor.

#### 1.4 SUBMITTALS

- A. Shop Drawings:
  - 1. Comply with Division 1.
  - 2. Include catalog numbers and specifications of Case Systems, Midland, Michigan.
  - 3. Submit three sets of laser quality, 11" x 17" shop drawings consisting of:
    - a. Finish, hardware, construction options selection sheet.
    - b. Small scale floor plan showing casework in relation to the building.
    - c. Large scale elevations and plan views.
    - d. Cross-sections; service runs; locations of blocking within walls (blocking is done by others); rough-in requirements and, sink centerlines
  - 4. Approved shop drawings to be returned to manufacturer at least 60 days before production.
  - 5. Project Architect and Construction Manager must approve all items prior to fabrication and delivery of casework.
  - 6. Manufacturer and/or Manufacturer's rep verifies all critical building dimensions prior to fabrication.
- B. Samples:
  - 1. Submit one set of laminate color brochures from standard laminate manufacturers Wilsonart, Formica, Pionite, and Nevamar.
  - 2. Submit one edge color sample chain.
  - 3. Submit one set of interior colors samples.
  - 4. Submit catalog showing construction details, material specifications and hardware specifications of all items used.
  - 5. Provide product data for casework core being manufactured without the use of urea formaldehyde.
- C. Warranty:
  - 1. Provide sample warranty document stating specified terms as referenced in 1.8.

#### 1.5 QUALITY ASSURANCE

- A. Unless otherwise indicated, comply with AWI, for grades of interior architectural woodwork, construction, finishes and other requirements:
  - 1. Provide AWI Quality Certification Program Labels and/or Certificates indicating that the woodwork, complies with requirements of grades specified. Casework manufacturer, upon award of work, shall register the work under this section with the AWI Quality Certification Program (800-449-8811).

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements:



1. Deliver casework once painting, and similar requirements have been completed that will not damage casework. This includes ensuring spaces are enclosed and weather tight.
  2. All casework shall be blanket wrapped for protection during shipping.
- B. Storage and Handling:
1. Casework must be protected from dust, dirt and/or other trades.
  2. Countertops are stacked, properly supported and spaced evenly to avoid warping. Large pieces are stacked first on the pallets with shorter pieces stacked on top.

## 1.7 SITE CONDITIONS

- A. Ambient Conditions:
1. Do not deliver or install the casework until concrete, masonry, and drywall/plaster work is dry; ambient relative humidity is maintained between 25 – 55% prior to delivery and throughout the life of installation; and the temperature is controlled above 55°F.
  2. Casework shall not be stored or installed in non-climate controlled conditions.

## 1.8 WARRANTY

- A. Casework manufacturer shall offer a Five-Year warranty to the original owner against defective material and workmanship.
1. The warranty specifically does not cover any product or hardware, which has been incorrectly installed, including poor climate conditions, exposed to excessive loads or abuse.
  2. All non-casework items supplied, but not manufactured by Casework manufacturer including, but not limited to sinks, fixtures, apparatus, lights, power outlets, and power strips shall be covered under the original manufacturers' warranty.

## PART 2– PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: LCI Casework, 704 West Main Street, Teutopolis, IL 62467
- B. Approved Equal.
- C. Substitution Limitations:
1. Substitutions will be considered only when other manufacturers submit substitution requests in accordance with procurement substitution and/or substitution procedures, or provide a comparable product with the following support information detailed below:
    - a. Written documentation stating specification compliance regarding construction, materials, and standard of quality and manufacturing techniques.
    - b. Note all deviations to the drawings and/or specifications in writing.
    - c. The owner, or its designated representative, reserves the right to reject any proposal that in his opinion fails to meet the criteria established by this specification. Such a decision shall be final.

### 2.2 MATERIALS

- A. Provide Plastic Laminate Faced Cabinets Manufactured with:

1. Particleboard Core: Low emitting – No added Urea Formaldehyde
  - a. All particleboard shall be Grade M-3 and shall meet or exceed all requirements as set by ANSI A208.1-2009.

Density	40-50 lbs/cu.ft
Moisture Content	10% Max
Modulus of Rupture	2393 psi
Modulus of Elasticity	398,900 psi
Internal Bond	80 psi
Hardness	500 pounds Min
Linear Expansion	0.35%
Thickness Tolerance	+/- 0.008"
Face Screw Holding	247 pounds Min
- B. Joinery:
  1. Mechanical Joinery:
    - a. All cabinet body components shall be secured utilizing concealed interlocking mechanical fasteners as approved by the AWI Quality Standards 8th Edition - 2003 Sections 400A-T-12, 400B-T10 and 1600-T-11.
- C. Surface Material:
  1. Acceptable laminate color, pattern, and finish as either scheduled or otherwise indicated on drawings, types and nominal thickness including:
    - a. Vertical surface decorative grade VGS: .028" thick
    - b. General purpose decorative grade HGS: .048" thick
    - c. Cabinet decorative liner grade CLS: .020" thick
    - d. Non-decorative backer grade BKH: .028" thick
    - e. Thermally fused melamine laminate
- D. Edge banding:
  1. PVC
    - a. Shall be applied utilizing hot melt adhesive and radiused by automatic trimmers. Edging shall be available in a variety of color options.
- E. Adhesives:
  1. PVA
    - a. Adhesive shall be mechanically applied.
  2. No Added Urea Formaldehyde, no VOC

## 2.3 FABRICATION

- A. General Cabinet Body Construction:
  1. Cabinet Box Style shall be Reveal Overlay.
  2. Cabinet Box Core shall be NAUF Particleboard.
  3. Bottoms and ends of cabinets, and tops of tall cabinets and tops and bottoms of wall cabinets (all structural components) shall be 1" thick.
  4. All panels shall be manufactured with balanced construction.
  5. Fixed interior components such as fixed shelves, dividers, and cubicle compartments shall be full ¾" thick and attached with concealed interlocking mechanical fasteners.
  6. Cabinet body exterior surfaces shall be: HGS.
  7. Cabinet finished interior options shall be: Finished at All.

8. Cabinet body interior surfaces shall be: Thermally Fused.
  9. Cabinet body front edge shall be: 3mm PVC.
  10. Mounting stretchers are ¾" thick structural components fastened to end panels and back by mechanical fasteners, and are concealed by the cabinet back.
  11. When the rear of a cabinet is exposed, a separate finished ¾" thick decorative laminate back panel may be specified.
  12. Backs of cabinets are ½" thick surfaced both sides for balanced construction and fully captured on both sides and bottom.
  13. A 5mm diameter row hole pattern 32mm (1¼") on center shall be bored in cabinet ends for adjustable shelves. This row hole pattern shall also serve for hardware mounting and replacement and/or relocation of cabinet components.
  14. An upper ¾" thick stretcher shall be located behind the back panel and attached between the end panels with mechanical fasteners. This stretcher is also fastened to the full sub-top thus capturing the back panel.
- B. Base Cabinet Construction:
1. All base cabinets, except sink cabinets, shall have a solid ¾" thick sub-top of core (as specified above), fastened between the ends with interlocking mechanical fasteners.
  2. Sink cabinets with a split removable back panel shall have a formed metal front brace, and steel corner gussets shall be utilized to support and securely fasten top in all four corners. Front brace shall be powder coated black.
- C. Tall Cabinet Construction:
1. All tall cabinets shall be provided with an intermediate fixed shelf to maintain internal dimensional stability under heavy loading conditions as well as an intermediate ¾" thick stretcher located behind the back panel and be secured between the cabinet ends with mechanical fasteners. The stretcher shall be secured to the shelf through the back with #8 x 2" plated flat head screws.
- D. Wall Cabinet Construction:
1. All wall cabinet bottoms shall be 1" thick core (type specified above), mechanically fastened between end panels and secured to the bottom back stretcher. A lower ¾" thick stretcher shall be located behind the back panel and attached between the end panels with mechanical fasteners. The stretcher is also secured through the back and into the cabinet bottom.
  2. All wall cabinet exterior bottoms shall be: Match Exterior Surface.
  3. All wall cabinet tops shall be: Standard: ¾".
- E. Tall and Wall Cabinet Top Edges shall be: Standard: Raw.
- F. Tall and Wall Tops shall be: Material Match Standard Interior.
- G. Wall Upper Door Reveal shall be: Standard: 15mm Reveal.
- H. Toe Base of Cabinet:
1. Individual bases shall be constructed of: Moisture Resistance Pressure Treated Plywood factory applied to base and tall cabinets and shall support and carry the load of the end panels, and the cabinet bottom, directly to the floor. The base shall be let in from the sides and back of the cabinet to allow cabinets to be installed tightly together and tight against a wall, also to conceal the top edge of applied vinyl base molding (not supplied by casework manufacturer). There shall be a front to back center support for all bases over 30" wide.
  2. Toe Base Height Standard: 4".

3. Toe Base Options Attached.
- I. Drawer Fronts and Solid Doors:
    1. All drawer fronts and solid door components shall be: NAUF Particleboard surfaced both sides for balanced construction.
    2. Options shall be: HPL Door and Drawer Front Exterior and Grade CLS on Interior.
    3. Surfaces shall be: HPL Grade HGS.
    4. Door and drawer front edge shall be: Standard: 3mm PVC.
  - J. Drawer Boxes:
    1. Drawer box constructed with a full ½” thick core shall be: NAUF Particleboard non-racking, non-deflecting platform bottom that is carried directly by “L” shaped, bottom mount drawer glides.
    2. Drawer box at finished interiors shall be: Surface to Match Standard Interior.
    3. Slides are secured with 1¼” long screws driven through the platform and into the sides. Drawer box sides, backs, sub-front, and bottom shall be ½”. The top edge shall be nominal 1mm (.020") PVC matching the drawer color. Drawer box corners shall be joined with fluted hardwood dowels and glue spaced at a minimum of 32mm on center. Drawer box fronts shall be removable and attached to drawer box sub-front with screws from inside of drawer. Horizontal parting rails between drawers shall be ¾” thick core, with balanced surfaces, secured to and further reinforcing cabinet ends.
  - K. Doors:
    1. Solid Doors shall be: Standard: ¾" thick core.
  - L. Shelves:
    1. Adjustable:
      - a. Adjustable shelves shall be: NAUF Particleboard core, with balanced surfaces.
      - b. Adjustable shelves in closed cabinets shall be: Standard: ¾" Shelves, 1" for Shelves Over 36" Wide and Open Cabinets.
      - c. Adjustable shelf edge on open cabinets shall be: .020" Match Edge at Front.
      - d. Adjustable shelf edge on closed cabinets shall be: .020" Match Edge at Front.
      - e. Adjustable shelf shall be set back 23mm setback option when locks are used.
    2. Fixed:
      - a. Fixed shelves shall be: NAUF Particleboard.
      - b. Fixed shelves shall be: ¾" Shelves, 1" for Shelves Over 36" Wide and Open Cabinets.
      - c. Fixed shelf surfaces on closed cabinets shall be: Match Interior Selections.
      - d. Fixed shelf surfaces on open cabinets shall be: Match Interior Selections.
  - M. Specialty Products:
    1. Countertops:
      - a. High-pressure decorative laminate, nominal 1" thick solid core, conforming to NEMA Standard LD3-2005 and ANSI A161.2-1998.
        1. General Purpose HGS on horizontal surface.
        2. Laminate bonded to M-2 NAUF Moisture Resistant Particleboard core with PVA rigid adhesives. Core shall be balanced with backing Grade BKL.

3. All joints shall be secured with biscuits for alignment and tight joint fasteners.
4. Provide 4" high back splashes with thickness matching countertop thickness where shown and at all ends abutting walls and adjacent cabinets.
5. Provide edges, self-edge of the same material as top.
6. The maximum lengths of HPL buildup particleboard tops is 12'-0" and the maximum lengths of HPL buildup plywood tops is 8'-0".

## 2.4 FINISHES

- A. Plastic Laminate Casework Colors:
  1. High Pressure Laminate is standard suede finishes from our select laminate manufacturers, including:
    - a. Wilsonart
    - b. Color: as selected by Owner from manufacturer's full range.
  2. Thermally Fused Melamine Laminate that meets performance requirements of ANSI/NEMA 3 LD – 2005 for GP-28.
    - a. Wilsonart
    - b. Color: as selected by Owner from manufacturer's full range
  3. Cabinet Liner .020" thick, high-pressure cabinet liner conforming to ANSI/NEMA 3 LD – 2005, Grade CLS. Surface texture shall be similar to exterior finish. Color shall match interior.
    - a. Color: as selected by Owner from manufacturer's full range.
- B. Plastic Laminate Countertop Colors:
  - a. Wilsonart.
  - b. Color: as selected by Owner from manufacturer's full range.
- C. Accessories:
  1. Hinges:
    - a. 5-Knuckle Hinge / Reveal Overlay: Brushed Chrome.
  2. Pulls:
    - a. Aluminum Wire
- D. Countertop Supports shall be in one of our standard colors: Light Neutral.
- E. Round Grommets where indicated shall be: Black.

## 2.5 ACCESSORIES

- A. Hardware:
  1. Hinges:
    - a. 5-Knuckle Hinges / Reveal Overlay: Hinges shall be: .095" thick steel five-knuckle hospital-tip, institutional Grade (Grade 1 per ANSI/BHMA A156.9) quality with .187" diameter tight pin. Each hinge shall be secured with a minimum of nine No. 8 screws. Hinge shall permit door to swing 270° without binding. Doors less than 48" in height shall have two hinges. Doors over 48" in height shall have three hinges.

2. Pulls:
  - a. One pull shall be: located at the centerline of the drawer, regardless of width, to ensure ease of operation and maximize drawer slide life.
    1. Anodized aluminum wire pull, 8mm diameter with 96mm O.C. mounting holes.
3. Drawer Slides:
  - a. Standard drawer: Self-closing, bottom mount epoxy coated with captive roller and positive in stop. Slide shall have 100 lb. load rating, must be: self-closing and must prevent drawer fronts from contacting the cabinet body. Drawer slides must meet or exceed Grade 1 requirements per ANSI A156.9/BHMA with full extension slides on file and paper storage.
4. Shelf Clips:
  - a. Standard: Plastic
    1. Shelf clips shall be injected molded clear plastic, with a double pin engagement 32mm on center and shall have ¾" and 1" anti-tip locking tabs as approved in AWI 400B-T-9 for premium Grade.
5. Locks:
  - a. Lock Locations:
    1. Locks at All.
  - b. Lock Type:
    1. Standard Lock - National: Five disc tumbler cam locks, chrome plated steel faceplate. All locks keyed alike or keyed differently by room and master keyed. Shall permit a minimum of 50 keying options. Lock core is removable permitting owner to easily change lock arrangements. Inactive door of base and wall cabinets shall be: secured by using an elbow catch, or a chain pull for tall cabinets.
6. Catches:
  - a. Catches shall be: Magnetic at Base and Wall.\

## PART 3 – EXECUTION

### 3.1 INSTALLERS

- A. Installation shall be: by casework manufacturer's authorized representative.

### 3.2 INSTALLATION

- A. Casework shall not be: installed until concrete, masonry, and drywall/plaster work is dry.
- B. Casework shall be: installed plumb and true and is to be securely anchored in place.
- C. The casework contractor shall verify all critical building dimensions prior to fabrication of casework.
- D. Provide all labor for unloading, distribution, and installation of casework and related items as specified.
- E. All casework shall be: securely anchored to horizontal wall blocking, not to plaster lathe or wall board.
- F. The casework manufacturer shall re-configure the casework arrangements to dimensions requiring 2½" or less of filler at each end of wall-to-wall elevations, and to ensure a complete and satisfactory installation.

- G. The casework installer shall remove all debris, sawdust, scraps, and leave casework spaces clean.
- H. All casework must be installed by casework installer plumb and level, adjust all doors, drawers and hardware to comply with manufacturers specifications and operate properly.

END OF SECTION 06 41 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Firestopping of through-penetrations in fire-rated assemblies.
  - 2. Firestopping of joints in fire-rated assemblies.
  - 3. Firestopping of tops of fire-rated walls.
  - 4. Smoke sealing at joints between floor slabs and exterior walls.
  - 5. Smoke sealing of penetrations and joints in smoke partitions.

1.2 DEFINITIONS

- A. F-rating (Flame Rating): A number indicating the length of time that a barrier can withstand fire before being consumed or before permitting the passage of flame through the opening; expressed in hours.
- B. Firestopping (Through-Penetration Protection System): The sealant, stuffing material, or assembly placed in spaces between and in penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire-rated construction.
- C. Intumescent Firestopping: A seal in openings in fire-rated wall, roof, or floor assemblies, designed to expand significantly when exposed to sufficient heat.
- D. T-rating (Thermal Rating): A number indicating the length of time that the temperature on the non-fire side of the penetration does not exceed 325°F above the ambient temperature; expressed in hours.

1.3 REFERENCE STANDARDS

- A. ASTM International:
  - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
  - 3. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
  - 4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- B. California Department of Public Health:
  - 1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.
- C. Forest Stewardship Council:
  - 1. FSC Guidelines.
- D. Intertek Testing Services (Warnock Hersey Listed):
  - 1. WH - Certification Listings.

- E. South Coast Air Quality Management District:
  - 1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.
- F. UL:
  - 1. UL - Fire Resistance Directory.
  - 2. UL 263 - Standard for Fire Tests of Building Construction and Materials.
  - 3. UL 1479 - Standard for Fire Tests of Penetration Firestops.
  - 4. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.

#### 1.4 SUBMITTALS

- A. Section 01 33 00 "Submittal Procedures:" Requirements for submittals.
- B. Product Data: Submit manufacturer's information regarding product characteristics, performance, and limitation criteria.
- C. Manufacturer's Certificate: Certify that products meet or exceed applicable code requirements.
- D. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire-protection requirements.
- E. Manufacturer Instructions:
  - 1. Submit preparation and installation instructions.
  - 2. Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire-resistance rating of adjacent assembly.
- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- G. Qualifications Statements:
  - 1. Submit qualifications for manufacturer, applicator, and licensed professional.
  - 2. Submit manufacturer's approval of applicator.

#### 1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 "Sustainable Design Requirements:" Requirements for sustainable design submittals.
- B. Manufacturer's Certificate:
  - 1. Certify that products meet or exceed specified sustainable design requirements.
  - 2. Sustainable Sites Certificate: Certify paving materials' Solar Reflectance Index (SRI).
  - 3. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for regional materials and distance from Project Site.
    - c. Certify that lumber is harvested from Forest Stewardship Council (FSC) Certified well-managed forest.
  - 4. Indoor Air Quality Certificates:
    - a. Certify VOC content for each interior adhesive and sealant and related primer.
    - b. Certify that each composite wood product contains no added urea formaldehyde resins.

#### 1.6 QUALITY ASSURANCE

- A. Comply with applicable code for fire-resistance ratings and surface-burning characteristics.

- B. Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.
- C. Products:
  - 1. Different types of products by multiple manufacturers are acceptable as required to meet specified system description and requirements.
  - 2. Provide only one type for each similar application.
- D. Through-Penetration Firestopping of Fire-Rated Assemblies:
  - 1. Comply with ASTM E814.
  - 2. Minimum Positive Pressure Differential: 0.10" wg.
  - 3. Fire F-Ratings and Temperature T-Ratings: As indicated on Drawings, but not less than 1 hour.
  - 4. Wall Penetrations: Fire F-ratings as indicated on Drawings, but not less than 1 hour.
  - 5. Floor and Roof Penetrations:
    - a. Fire F-ratings and temperature T-ratings as indicated on Drawings, but not less than 1 hour.
    - b. Floor Penetrations within Wall Cavities: T-rating not required.
- E. Through-Penetration Firestopping of Non-fire-rated Floor and Roof Assemblies:
  - 1. Materials: Resist free passage of flame and products of combustion.
  - 2. Noncombustible Penetrating Items: For items connecting maximum of three stories.
  - 3. Penetrating Items: Materials approved by authorities having jurisdiction for items connecting maximum of two stories.
- F. Fire-Resistant Joints in Fire-Rated Floor, Roof, and Wall Assemblies:
  - 1. Comply with ASTM E1966 or UL 2079 to achieve fire-resistant rating as indicated on Drawings for assembly in which joint is installed.
  - 2. Smoke Barrier Joints Air Leakage: Maximum 5 cfm/ft. at 0.30" wg pressure differential.
- G. Fire-Resistant Joints between Floor Slabs and Exterior Walls: Comply with ASTM E119 with 0.10" wg minimum positive pressure differential to achieve fire-resistant rating as indicated on Drawings for floor assembly.
- H. Surface-Burning Characteristics:
  - 1. Maximum Flame-Spread/Smoke-Developed Index: 25/450.
  - 2. Testing: Comply with ASTM E84.
- I. Maintain one copy of each standard affecting Work of this Section on Site.

## 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Applicator:
  - 1. Company specializing in performing Work of this Section with minimum three years documented experience and approved by manufacturer.
- C. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of New Jersey.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 "Product Requirements:" Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Provide additional protection according to manufacturer instructions.

## 1.9 AMBIENT CONDITIONS

- A. Section 01 50 00 "Temporary Facilities and Controls:" Requirements for ambient condition control facilities for product storage and installation.
- B. Minimum Conditions: Do not apply materials if temperature of substrate material and ambient air is below 60°F.
- C. Subsequent Conditions: Maintain above minimum temperature before, during, and for minimum three days after installation of materials.
- D. Provide ventilation in areas receiving solvent-cured materials.

## PART 2 - PRODUCTS

## 2.1 FIRESTOPPING

- A. Manufacturers:
  - 1. Hilti Corp.
  - 2. 3M Fire Protection Products.
  - 3. Pecora Corporation.
  - 4. Spec Seal Firestop Products.
  - 5. Substitutions: As specified in Section 01 60 00 "Product Requirements."
- B. Description:
  - 1. Silicone Elastomeric Firestopping: Single-component silicone elastomeric compound and compatible silicone sealant.
  - 2. Foam Firestopping Compounds: Single-component.
  - 3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with noncombustible non-asbestos fibers.
  - 4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stoppage.
  - 5. Mechanical Firestopping Device with Fillers:
    - a. Mechanical device with noncombustible fillers and silicone elastomer.
    - b. Cover: Stainless-steel sheet jacket joined with collars.
    - c. Penetration Seal: Flanged stops.
  - 6. Intumescent Firestopping: Putty compound that expands on exposure to surface heat gain.
  - 7. Firestop Pillows: Formed mineral fiber.

- 8. Mortar:
  - a. If permitted by applicable code.

C. Color: As selected from manufacturer's full range of colors.

## 2.2 ACCESSORIES

- A. Primer: Type as recommended by firestopping manufacturer for specific substrate surfaces and as suitable for required fire ratings.
- B. Permanent Dam Material:
  - 1. Mineral fiberboard.
- C. Installation Accessories: Furnish clips, collars, fasteners, temporary stops or dams, and other devices as required to position and retain materials in place.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 01 73 00 "Execution:" Requirements for examination.
- B. Verify that openings are ready to receive firestopping.

### 3.2 PREPARATION

- A. Section 01 73 00 "Execution:" Requirements for preparation.
- B. Clean substrate surfaces free of dirt, dust, grease, oil, loose material, or other matter potentially affecting bond of firestopping material.
- C. Remove incompatible materials potentially affecting bond.
- D. Install backing or damming materials to arrest liquid material leakage.

### 3.3 APPLICATION

- A. Install material at fire-rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit, and other items requiring firestopping.
- B. Apply primer where recommended by manufacturer based on type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.
- D. Compress fibered material to maximum 40% of its uncompressed size.
- E. Place intumescent coating in sufficient coats to achieve required rating.
- F. Dams: Remove dam material after firestopping material has cured unless it is a required component of the tested assembly.

### 3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 "Quality Requirements:" Requirements for inspecting and testing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.
- C. Acceptance: Adjust, repair, modify, or replace components failing to perform as specified and re-inspect.

3.5 CLEANING

- A. Section 01 77 00 “Closeout Procedures:” Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION

- A. Section 01 77 00 “Closeout Procedures:” Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.7 ATTACHMENTS

A. FIRESTOPPING SCHEDULE:

- 1. Fire Ratings:
  - a. Main Floor Fire Walls: 1 hr.
  - b. Stair Walls: 2 hr.
  - c. Room-to-Room Partitions, Metallic Pipe, and Conduit:  $\frac{3}{4}$  hr.
  - d. Room-to-Room Partitions, Non-metallic Pipe, and Conduit:  $\frac{3}{4}$  hr.
  - e. Floors, Metallic Pipe, and Conduit: 1 hr.

END OF SECTION 07 84 00

SECTION 07 90 00

JOINT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Sealants and joint backing.
  - 2. Precompressed foam sealers.
  - 3. Hollow gaskets.
  - 4. Accessories.
  
- B. Related Requirements:
  - 1. Section 07 84 00 "Firestopping:" Firestopping sealants.
  - 2. Section 08 80 00 "Glazing:" Glazing sealants and accessories.
  - 3. Section 09 21 16 "Gypsum Board Assemblies:" Acoustic sealant.
  - 4. Section 09 30 00 "Tiling:" Sealant used as tile grout.

1.2 REFERENCE STANDARDS

- A. ASTM International:
  - 1. ASTM C834 - Standard Specification for Latex Sealants.
  - 2. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
  - 3. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
  - 4. ASTM C1193 - Standard Guide for Use of Joint Sealants.
  - 5. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
  - 6. ASTM D1667 - Standard Specification for Flexible Cellular Materials – Poly (Vinyl Chloride) Foam (Closed-Cell).
  - 7. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
  
- B. California Department of Health Services:
  - 1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.
  
- C. South Coast Air Quality Management District:
  - 1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

1.3 COORDINATION

- A. Section 01 30 00 "Administrative Requirements:" Requirements for coordination.
- B. Coordinate Work of this Section with Sections referencing this Section.

1.4 SUBMITTALS

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

- B. Product Data: Submit manufacturer information indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit special procedures, surface preparation requirements, and perimeter conditions requiring special attention.
- E. Qualifications Statements:
  - 1. Submit qualifications for manufacturer and applicator.

#### 1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 "Sustainable Design Requirements:" Requirements for sustainable design submittals.
- B. Manufacturer's Certificate:
  - 1. Certify that products meet or exceed specified sustainable design requirements.
  - 2. Materials Resources Certificates: Certify source for regional materials and distance from Project Site.
  - 3. Indoor Air Quality Certificates: Certify VOC content for each interior adhesive, sealant, and related primer.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work according to applicable standards.
- B. Maintain one copy of each standard affecting Work of this Section on Site.

#### 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 "Product Requirements:" Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store products according to manufacturer instructions.
- D. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Provide additional protection according to manufacturer instructions.

#### 1.9 AMBIENT CONDITIONS

- A. Section 01 50 00 "Temporary Facilities and Controls:" Requirements for ambient condition control facilities for product storage and installation.
- B. Maintain temperature and humidity as recommended by sealant manufacturer during and after installation.



1.10 WARRANTY

- A. Section 01 73 00 "Execution:" Requirements for warranties.
- B. Furnish two year installer's warranty.
- C. Include coverage for:
  - 1. Installed sealants and accessories failing to achieve airtight or watertight seal.
  - 2. Installed sealants and accessories exhibiting loss of adhesion or cohesion.
  - 3. Sealants that do not cure.

PART 2 - PRODUCTS

2.1 JOINT SEALERS

- A. Manufacturers:
  - 1. BASF Building Systems.
  - 2. Dow Corning Corporation.
  - 3. GE Advanced Materials - Silicones.
  - 4. May National Associates, Inc.
  - 5. Pecora Corporation.
  - 6. Polymeric Systems, Inc.
  - 7. Schnee-Morehead, Inc.
  - 8. Sika Corporation; Construction Products Division.
  - 9. Bostik, Inc.
  - 10. Substitutions: As specified in Section 01 60 00 "Product Requirements."

2.2 JOINT SEALERS BY APPLICATION

- A. High-Performance General-Purpose Exterior (Nontraffic) Sealant:
  - 1. Material: Silicone or Polyurethane.
  - 2. Comply with ASTM C920, Grade NS, Class 25, Uses M, G, and A.
  - 3. Type: Single-component.
  - 4. Color: Standard; match finished surfaces.
  - 5. Applications:
    - a. Control, expansion, and soft joints in masonry.
    - b. Joints between concrete and other materials.
    - c. Joints between metal frames and other materials.
    - d. Other exterior nontraffic joints for which no other sealant is indicated.
- B. General-Purpose Traffic-Bearing Sealant:
  - 1. Material: Polyurethane.
  - 2. Comply with ASTM C920, Grade P, Class 25, Use T.
  - 3. Type: Single-component.
  - 4. Color: Standard; match finished surfaces.
  - 5. Applications: Exterior and interior pedestrian and vehicular traffic-bearing joints.
- C. Exterior Foam Expansion Joint Sealer:
  - 1. Description: Pre-compressed foam sealer recommended by manufacturer for traffic-bearing use.

2. Material: Polyurethane with water repellent.
3. Color: Black.
4. Size: As required to provide watertight seal when installed.
5. Applications: Exterior wall and parking deck expansion joints.

D. Exterior Metal Lap Joint Sealant:

1. Material: Butyl or polyisobutylene.
2. Type: Non-drying, non-skinning, non-curing.
3. Applications: Concealed sealant bead in sheet metalwork.

E. General Purpose Interior Sealant:

1. Material: Acrylic-emulsion latex.
2. Comply with ASTM C834.
3. Type: Single-component; paintable.
4. Color: Standard; match finished surfaces.
5. Applications:
  - a. Interior wall and ceiling control joints.
  - b. Joints between door and window frames and wall surfaces.
  - c. Other interior joints for which no other type of sealant is indicated.

F. Sanitary Sealant:

1. Material: Silicone.
2. Comply with ASTM C920, Uses M and A.
3. Type: Single-component; mildew resistant.
4. Color: As selected.
5. Applications:
  - a. Joints between plumbing fixtures and floor and wall surfaces.
  - b. Joints between kitchen and bathroom countertops and wall surfaces.

G. Acoustical Sealant:

1. Material: Butyl or acrylic.
2. Comply with ASTM C920, Grade NS, Class 12-1/2, Uses M and A.
3. Type: Single-component; solvent-release curing; non-skinning.
4. Applications: Concealed locations only at acoustically rated construction.

H. Sealant for Continuous Water Immersion:

1. Material: Polysulfide or polyurethane.
2. Comply with ASTM C920, Grade NS, Class 25, Uses M and A.
3. Type: Single-component; approved by manufacturer for continuous water immersion.
4. Color: Standard; match finished surfaces.
5. Applications: Joints in fountain pools or aquariums.

## 2.3 JOINT SEALERS BY TYPE

A. Acrylic-Emulsion Latex Sealant:

1. Comply with ASTM C834.
2. Type: Single-component; non-staining, non-bleeding, non-sagging.
3. Color: Standard; match finished surfaces.
4. Movement Capability: 2-5%.
5. Service Temperature Range: 2-160°F.

6. Hardness Range: Shore A, 15 to 40.
- B. Acrylic Sealant:
1. Comply with ASTM C920, Grade NS, Class 12-1/2, Uses NT, M, A, and O.
  2. Type: Single-component; solvent release curing; non-staining, non-bleeding, non-sagging.
  3. Color: Standard; match finished surfaces.
  4. Movement Capability:  $\pm 12 \frac{1}{2}\%$ .
  5. Service Temperature Range: -13 to 180°F.
  6. Hardness Range: Shore A, 25 to 50.
- C. Butyl Sealant:
1. Comply with ASTM C920, Grade NS, Class 12-1/2, Use NT.
  2. Type: Single-component; solvent release curing; non-skinning, non-sagging.
  3. Color: Black.
  4. Movement Capability:  $\pm 12 \frac{1}{2}\%$ .
  5. Service Temperature Range: -13 to 180°F.
  6. Hardness Range: Shore A, 10 to 30.
- D. Non-sag Polysulfide Sealant:
1. Comply with ASTM C920, Grade NS, Class 25, Uses NT, M, A.
  2. Type: Two-component; chemically curing; non-staining, non-bleeding, non-sagging; capable of continuous water immersion.
  3. Color: Standard; match finished surfaces.
  4. Movement Capability:  $\pm 25\%$ .
  5. Service Temperature Range: -40 to 180°F.
  6. Hardness Range: Shore A, 20 to 35.
- E. Self-Leveling Polysulfide Sealant:
1. Comply with ASTM C920, Grade P, Class 25, Uses T and M.
  2. Type: Two-component; chemically curing; non-staining, non-bleeding; capable of continuous water immersion; self-leveling.
  3. Color: Standard; match finished surfaces.
  4. Movement Capability:  $\pm 25\%$ .
  5. Service Temperature Range: -40 to 180°F.
  6. Hardness Range: Shore A, 20 to 35.
- F. Non-sag Polyurethane Sealant:
1. Comply with ASTM C920, Grade NS, Class 25, Uses NT and M.
  2. Type: Single-component; chemical curing; non-staining, non-bleeding, non-sagging; capable of continuous water immersion].
  3. Color: Standard; match finished surfaces.
  4. Movement Capability:  $\pm 25\%$ .
  5. Service Temperature Range: -40 to 180°F.
  6. Hardness Range: Shore A, 20 to 35.
- G. Self-Leveling Polyurethane Sealant:
1. Comply with ASTM C920, Grade P, Class 25, Uses T, M, and A.
  2. Type: Single-component; chemical curing; non-staining, non-bleeding; capable of continuous water immersion; self-leveling.

3. Color: Standard; match finished surfaces.
4. Movement Capability:  $\pm 25\%$ .
5. Service Temperature Range: -40 to 180°F.
6. Hardness Range: Shore A, 20 to 35.

H. Silicone Sealant:

1. Comply with ASTM C920, Grade NS, Class 25, Uses NT and A.
2. Type: Single-component; solvent curing; non-sagging, non-staining, non-bleeding; fungus resistant].
3. Color: Standard, match finished surfaces.
4. Movement Capability:  $\pm 25\%$ .
5. Service Temperature Range: -65 to 180°F.
6. Hardness Range: Shore A, 15 to 35.

2.4 ACCESSORIES

A. Primer:

1. Type: Non-staining.
2. As recommended by sealant manufacturer to suit application.

B. Joint Cleaner:

1. Type: Non-corrosive and non-staining.
2. As recommended by sealant manufacturer.
3. Compatible with joint forming materials.

C. Joint Backing:

1. Description: Round foam rod, compatible with sealant.
2. Comply with ASTM D1056, sponge or expanded rubber.
3. Size: Oversized 30 to 50% larger than joint width.

D. Bond Breaker:

1. Description: Pressure-sensitive tape.
2. As recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 73 00 "Execution:" Requirements for application examination.
- B. Verify that substrate surfaces and joint openings are ready to receive Work of this Section.
- C. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Section 01 73 00 "Execution:" Requirements for application preparation.
- B. Comply with ASTM C1193.
- C. Remove loose materials and foreign matter that could impair adhesion of sealant.
- D. Clean and prime joints.
- E. Protect elements surrounding Work of this Section from damage or disfiguration.

### 3.3 APPLICATION

- A. Comply with ASTM C1193.
- B. Acoustical Sealant:
  - 1. Comply with ASTM C919.
  - 2. Provide sealant bead between top stud runner and structure, and between bottom stud track and floor.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated on Drawings.
- D. Install bond breaker where joint backing is not used.
- E. Apply sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Joint Tooling: Concave.
- G. Pre-compressed Foam Sealant:
  - 1. Do not stretch.
  - 2. Avoid joints except at corners, ends, and intersections.
  - 3. Apply with face  $\frac{1}{8}$ " to  $\frac{1}{4}$ " below adjoining surface.
- H. Compression Gaskets:
  - 1. Avoid joints except at ends, corners, and intersections.
  - 2. Seal joints with adhesive.
  - 3. Install with face  $\frac{1}{8}$ " to  $\frac{1}{4}$ " below adjoining surface.

### 3.4 CLEANING

- A. Section 01 77 00 "Closeout Procedures:" Requirements for cleaning.
- B. Clean adjacent soiled surfaces.

### 3.5 PROTECTION

- A. Section 01 77 00 "Closeout Procedures:" Requirements for protecting finished Work.
- B. Protect sealants until cured.

END OF SECTION 07 90 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. SECTION INCLUDES

1. Work under this section comprises of furnishing hollow metal doors and frames, including transom frames, sidelight and window frames with provision for glazed, paneled or louvered openings, fire labeled and non-labeled, as scheduled.

B. RELATED DOCUMENTS

1. Related documents, drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 specification sections apply to this section.

C. RELATED SECTIONS

1. 08 14 16 “Flush Wood Doors and Hardware.”
2. 08 71 00 “Door Hardware.”
3. 09 90 00 “Painting and Coating.”

1.02 REFERENCES

A. STANDARDS

1. NFPA-80 – Fire Doors and Windows
2. ANSI/SDI-A250.8 – Recommended Specifications for Standard Steel Doors and Frames
3. SDI-105-91 – Recommended Erection Instructions for Steel Frames
4. SDI-107-78 – Hardware on Steel Doors (reinforcement application)
5. ANSI-A250.4 – Steel Doors and Frames Physical Endurance

B. CODES

1. NFPA-101-1994 – Life Safety Code
2. UBC 1997 – Uniform Building Code
3. IBC 2000 – International Building Code
4. ANSI-A117.1 – Accessible and Usable Building and Facilities
5. ADA – Americans with Disabilities Act

1.03 SUBMITTALS

A. GENERAL REQUIREMENTS

1. Submit copies of the hollow metal door and frame shop drawings in accordance with Division 1, General Requirements.

B. PRODUCT DATA

1. Submit shop drawings showing fabrication and installation of standard steel doors and frames. Include details of each frame type, elevations of door and frame types, conditions at

openings, details of construction, location and installation requirements of door and frame hardware reinforcements, and details of joints and connections. Show anchorage and accessory items.

#### C. SHOP DRAWINGS

1. Provide a schedule of doors and frames using same reference numbers for details and door openings as those on the contract documents. Shop drawings should include the following information:
  - a. Material thickness and/or gauge.
  - b. Door core material.
  - c. Mortises and reinforcements.
  - d. Anchorage types.
  - e. Locations of exposed fasteners.
  - f. Glazed, louvered and paneled openings.
  - g. Mounting locations of standard hardware.

### 1.04 QUALITY ASSURANCE

#### A. SUBSTITUTIONS

1. All substitution requests must be submitted within the procedures and time frame as outlined in Division 1, General Requirements. Approval of products is at the discretion of the architect and his consultant.

#### B. MANUFACTURER QUALIFICATIONS

1. Manufacturer shall be a member in good standing of the Steel Door Institute (SDI.)

#### C. FIRE RATED DOOR ASSEMBLIES

1. All labeled fire door assemblies to be of a type that have been classified and listed in accordance with the latest edition of NFPA80 and test in compliance with NFPA-252, UL-10B, and UBC-7-2. A physical label is to be affixed to the fire door at an authorized facility; embossed labels are acceptable on standard 3 sided door frames.
2. For openings required to be fire rated exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.
3. Project requires door assemblies and components that are compliant with positive pressure and S-label requirements. Specifications must be cross-referenced and coordinated with hardware and other door manufacturers to ensure that total opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
  - a. Certification(s) of compliance shall be made available upon request by the Authority Having Jurisdiction.

### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. The supplier shall deliver all materials to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Supplier shall coordinate delivery times and schedules with the contractor.



- B. Deliver doors cardboard wrapped or crated to provide protection during transit and jobsite storage. Provide additional protection to prevent damage to any factory-finished doors. Mark all doors and frames with opening numbers as shown on the contract documents and shop drawings.
- C. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the architect. Otherwise, remove and replace damaged goods as directed.
- D. Store doors and frames at the building site in a dry and secure place.
  - 1. Place units on minimum 4" high wood blocking.
  - 2. Avoid use of non-vented plastic or canvas shelters that could create a humidity chamber.
  - 3. If cardboard wrapper on door becomes wet, remove carton immediately.
  - 4. Provide ¼" spaces between stacked doors to promote air circulation.

#### 1.06 WARRANTY

- A. All doors and frames shall be warranted in writing by the manufacturer against defects in materials and workmanship for a period of one (1) year commencing on the date of final completion and acceptance.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide standard hollow metal doors and frames by a certified SDI manufacturer:
  - 1. Ceco Corporation
  - 2. Curries Company
  - 3. Fleming

#### 2.02 MATERIALS

- A. All doors and frames shall be manufactured of commercial quality cold rolled steel per ASTM-A366 and A568 general requirements or galvanized to A40 or G60 minimum coating weight standard per ASTM-A924. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A569.
- B. Supports and anchors shall be fabricated of not less than 18-gauge sheet steel, galvanized where galvanized frames are used.
- C. Where items are to be built into exterior walls, inserts, bolts and fasteners shall be hot dipped galvanized in compliance with ASTM-A153, Class C or D as applicable.
- D. Rust inhibitive enamel or paint primer shall be used, baked on, and suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces on Steel Doors and Frames."
- E. Provide all hollow metal doors and frames receiving electrified hardware with molex wiring harness and concealed plug connectors on one end to accommodate up to twelve wires. Coordinate molex connectors on end of the wiring harness to plug directly into the electrified hardware and the electric hinge.

#### 2.03 FRAMES

- A. Provide hollow metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on the drawings and schedules. Conceal fastenings unless otherwise indicated.
  - 1. Interior Frames: Level 2, 16-gauge
  - 2. Exterior Frames: Level 2, 14-gauge galvanized
  - 3. Security Grade Frames: N/A
    - a. Ceco: SF Series
    - b. Curries: M Series
- B. Fabricate frames with mitered and faces only welded corners, re-prime at the welded areas. All welds to be flush with neatly mitered or butted material cuts.
- C. All frames shall have minimum 7-gauge hinge reinforcements, 14-gauge lock strike reinforcing, and 12-gauge closer reinforcing.
- D. Provide temporary shipping bars to be removed before setting frames.
- E. Except on weatherstripped frames, drill stops to receive three (3) silencers on strike jambs of single frames and two (2) silencers on heads of double frames.
- F. Provide minimum 0.0179" thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

#### 2.04 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.
  - 1. Clearances shall be no more than 1/8" at jambs and heads except between non-fire rated pairs of doors which may be no more than 1/4". Not more than 3/4" at the bottom of the doors.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from only cold-rolled steel sheet.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
  - 1. Unless otherwise indicated, provide exposed fasteners with countersunk flat or oval heads for exposed screws and bolts.
- E. Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI-107 and ANSI-A115 Series specifications for door and frame preparation for hardware.
- F. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site. Provide internal reinforcements for all doors to receive door closers and exit devices.
- G. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
- H. Provide glazing stops with minimum 0.0359" thick steel or 0.040" thick aluminum.

- I. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
- J. Provide screw-applied, removable, glazing beads on inside of glass and other panels in doors

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Install steel doors, frames, and accessories according to shop drawings, manufacturer's data, and as specified.
- B. Comply with provisions of SDI-105, "Recommended Erection Instructions for Steel Door Frames," unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
  - 1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
  - 2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
  - 3. At existing concrete or masonry construction, install at least 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
  - 4. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws.
  - 5. Install fire-rated frames according to NFPA 80.
- C. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100. Install fire rated doors with clearances specified in NFPA 80.

#### 3.02 ADJUSTING AND CLEANING

- A. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer
- B. Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08 11 13

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 08 14 16  
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid core doors with wood veneer faces.
2. Factory finishing wood doors.
3. Factory fitting wood doors to frames and factory machining for hardware.
4. Louvers installed in flush wood doors.
5. Light frames and glazing installed in wood doors.
6. Factory installed glazing in wood doors.

B. Related Sections:

1. Section 08 11 13 "Hollow Metal Doors and Frames".
2. Section 08 71 00 "Door Hardware".

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

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI A208.1 - Wood Particleboard.
3. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
4. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
5. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
6. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
7. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A classifications. Include factory finishing specifications.
- B. Shop Drawings shall include:
  1. Indicate location, size, and hand of each door.
  2. Indicate dimensions and locations of mortises and holes for hardware.
  3. Indicate dimensions and locations of cutouts.
  4. Indicate requirements for veneer matching.

5. Indicate location and extent of hardware blocking.
  6. Indicate construction details not covered in Product Data.
  7. Indicate doors to be factory finished and finish requirements.
  8. Indicate fire protection ratings for fire rated doors.
- C. Samples for Initial Selection: For factory finished doors.
1. Factory finishes applied to actual door face materials, approximately 8" x 10", for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
  2. Corner sections of doors, 8" x 10", with door faces and edges representing actual materials to be used.
    - a. Provide samples for each species of veneer and core material.
    - b. Finish veneer faced door samples with same materials proposed for factory-finished doors.
  3. Frames for light openings, 6" long, for each material, type, and finish required.
- D. Warranty: Provide sample of manufacturer's warranty.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors".
- C. Fire Rated Wood Doors: Doors 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 at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL10C.
1. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer's construction label, indicating compliance to independent 3<sup>rd</sup> party certification agency's procedure, except for size.
  2. Temperature Rise Limit: Where required 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°F (250°C) above ambient after 30 minutes of standard fire test exposure.
  3. Smoke Control Door Assemblies: Comply with NFPA 105.
    - 1) 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. Pre-Submittal Conference: Conduct conference in compliance with requirements in Section 01 31 19 "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package pre-finished doors individually in plastic bags and wrap bundles of doors in plastic sheeting.

- C. Mark each door on top rail with opening number used on Shop Drawings.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, 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.

## 1.7 WARRANTY

- A. 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 ¼" in a 42" x 84" section.
    - b. Telegraphing of core construction in wood face veneers exceeding 0.01" in a 3" span.
  - 2. Warranty includes 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 DOOR CONSTRUCTION – GENERAL

- A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium.
- B. Fire Rated Doors: Provide construction and core as needed to provide fire ratings indicated.
  - 1. Category A Edge Construction: Provide fire rated door edge construction with intumescent seals concealed by outer stile (Category A) at 45, 60, and 90 minute rated doors. Comply with specified requirements for exposed edges.
  - 2. Pairs: Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
    - a. Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals.
    - b. Where required for concealed hardware, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.
- C. Environmentally Responsible Doors: Provide doors constructed with the following environmentally responsible characteristics:
  - 1. Forest Certification: Provide wood doors made from wood-based materials and products that are certified in accordance with the Forest Stewardship Council's principles and criteria, for wood building components.
  - 2. Low-Emitting Materials (LEED for Schools Only): Fabricate doors with adhesives and composite wood products that 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."

## 2.2 CORE CONSTRUCTION

- A. Structural Composite Lumber Core Doors:
  - 1. Structural Composite Lumber: Engineered hardwood composite wood products tested in accordance with WDMA I.S.1A, Testing Cellulosic Composite Materials for Use in Fenestration Products containing no added Urea Formaldehyde.
  - 2. LEED: Meet requirements of IEQ4.4.
- B. Particleboard Core Doors:
  - 1. Particleboard: Wood fiber based materials complying with ANSI A208.1 Particleboard standard. Grade LD-2.
  - 2. Adhesive: Fully bonded construction using Polyurethane (PUR) glue.
  - 3. Blocking: As indicated under article "Blocking".
- C. Fire Resistant Composite Core Doors:
  - 1. Core: Non-combustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire protection rating indicated.
  - 2. Blocking: As indicated under article "Blocking".
  - 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 BLOCKING

- A. Fire Rated Doors:
  - 1. Provide blocking as indicated below:
    - a. HB1: 5" in doors indicated to have closers and overhead stops.
    - b. HB4: Two 5" x 14" lock blocking in doors indicated to have exit devices.
    - c. HB8: Two 5" x 14" corner blocking and two 5" x 14" lock blocking on doors to have vertical rod exit devices.

## 2.4 VENEERED DOORS FOR TRANSPARENT FINISH

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ASSA ABLOY Wood Doors (GR): GPD Series.
- B. Interior Solid Core Doors:
  - 1. Grade: Premium.
  - 2. Faces: Veneer grades as noted below; veneer minimum 1/50" (0.5mm) thickness at moisture content of 12% or less.
    - a. Plain Sliced Select White Maple, A grade faces. (Architect to confirm)
  - 3. Match between Veneer Leaves: Book match.
  - 4. Assembly of Veneer Leaves on Door Faces:
    - a. Running Match.
  - 5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.



6. Transom Match: Continuous match.
7. Vertical Edges: Matching same species as faces. Wood or composite material, one piece, laminated, or veneered. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.
8. Horizontal Edges: Solid wood or structural composite material meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.
10. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.

## 2.5 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" thick, factory primed for paint finish with baked enamel or powder coated finish.

## 2.6 LIGHT FRAMES AND GLAZING

- A. Wood Beads for Light Openings in Wood Doors up to and including 20-minute rating:
  1. Wood Species: Same species as door faces.
  2. Profile:
    - a. M1 Flush Bead.
    - b. At wood core doors with 20-minute fire protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Light Openings in Fire Rated Doors over 20-minute Rating: Manufacturer's standard frame formed of 0.048" thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.
  1. Manufacturers:
    - a. Air Louver (LV).
    - b. All Metal Stamping (AP).
    - c. Anemostat (AN).
    - d. Pemko (PE).
- C. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with the flush wood door manufacturer's written instructions.
  1. Pre-Installed Glazing: Install glazing in doors as indicated. Pre-installed glass to include all of the required glazing material.

## 2.7 FABRICATION

- A. Factory fit doors to suit frame opening sizes indicated.
  1. Comply with requirements in NFPA 80 for fire rated doors.
  2. Undercut: As required per manufacturer's templates and sill condition.
- B. Factory machine doors for hardware that is not surface applied. 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: Comply with applicable requirements in Section 08 80 00 "Glazing."
  3. Louvers: Factory install louvers in prepared openings.
- D. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Section 08 71 00 "Door Hardware". Wire nut connections are not acceptable.

## 2.8 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 top and bottom edges, edges of cutouts, and mortises.
- B. Transparent Finish: Provide a clear protective coating over the wood veneer allowing the natural color and grain of the selected wood species to provide the appearance specified. Stain is applied to the wood surface underneath the transparent finish to add color and design flexibility.
1. Finish: Meet or exceed WDMA I.S. 1A TR8 UV Cured Acrylated Polyester finish performance requirements.
  2. Staining:
    - a. Custom stain to match architect's sample.
  3. 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 jambs.
  2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

- B. Installation Instructions: Install doors and frames to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
  - 1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.
- C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- E. Field modifications to doors shall not be permitted, except those specifically allowed by manufacturer or fire rating requirements.

### 3.3 ADJUSTING

- A. Operation: Re-hang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors 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 08 14 16

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Extruded aluminum windows.
  - 2. Factory glazing including infill panels.
  
- B. Related Requirements:
  - 1. Section 06 10 53 "Miscellaneous Rough Carpentry:" Wood perimeter shims.
  - 2. Section 07 90 00 "Joint Protection:" Perimeter sealant and backup materials.

1.2 REFERENCE STANDARDS

- A. American Architectural Manufacturers Association:
  - 1. AAMA 101 - North American Fenestration Standard/Specification for windows, doors, and skylights.
  - 2. AAMA 501 - Methods of Test for Exterior Walls.
  - 3. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
  - 4. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems.
  - 5. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
  - 6. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
  - 7. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  - 8. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
  - 9. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
  - 10. AAMA IPCB - Standard Practice for the Installation of Windows and Doors in Commercial Buildings.
  - 11. AAMA MCWM-1 - Metal Curtain Wall Manual.
  
- B. American Society of Civil Engineers:
  - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
  
- C. ASTM International:
  - 1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

4. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  5. ASTM D3656/D3656M - Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
  6. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  7. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  8. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
  9. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
  10. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
  11. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
  12. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
  13. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.
- D. California Department of Public Health:
1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.
- E. Consumer Product Safety Commission:
1. 16 CFR 1201- Safety Standard for Architectural Glazing Materials.
- F. Glass Association of North America:
1. GANA Glazing Manual.
- G. Green Seal:
1. GC-03 - Anti-Corrosive Paints.
- H. National Fenestration Rating Council:
1. NFRC 100 - Procedure for Determining Fenestration Product U-factors.
- I. SSPC: The Society for Protective Coatings:
1. SSPC Paint 20 - Zinc-Rich Coating (Type I - Inorganic and Type II - Organic).
  2. SSPC Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel (Type I and Type II).
- 1.3 PREINSTALLATION MEETINGS
- A. Section 01 30 00 “Administrative Requirements:” Requirements for pre-installation meeting.

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

#### 1.4 SUBMITTALS

- A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
- B. Product Data: Submit manufacturer information showing component dimensions, anchorage and fasteners, glass, internal drainage, and typical details.
- C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related Work, and installation requirements.
- D. Samples:
  - 1. Submit two samples, 12” x 12” in size, illustrating window infill panels.
- E. Manufacturer's Certificate:
  - 1. Certify that products meet or exceed specified requirements.
  - 2. Certify product performance ratings by independent third party such as AAMA, California Association of Window Manufacturers, or NFRC as meeting or exceeding performance criteria tests.
- F. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- H. Qualifications Statements:
  - 1. Submit qualifications for manufacturer and installer.
  - 2. Submit manufacturer's approval of installer.

#### 1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 “Sustainable Design Requirements:” Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify that following products meet or exceed specified sustainable design requirements:
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for regional materials and distance from Project Site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify VOC content for each interior sealant and related primer.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for following products:
    - a. Products with recycled material content.
    - b. Regional products.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work according to following:
  - 1. Aluminum Windows: Fabricate and label window assemblies according to AAMA 101 for types of windows required.
- B. Perform Work according to applicable standards.

- C. Maintain one copy of each standard affecting Work of this Section on Site.

## 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 "Product Requirements:" Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Covering:
    - a. Protect factory-finished aluminum surfaces with wrapping.
    - b. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
  - 3. Provide additional protection according to manufacturer instructions.
- E. Handling: Comply with AAMA MCWM-1.

## 1.9 AMBIENT CONDITIONS

- A. Section 01 50 00 "Temporary Facilities and Controls:" Requirements for ambient condition control facilities for product storage and installation.
- B. Minimum Conditions: Do not install glazing materials when ambient temperature is less than 40°F.
- C. Subsequent Conditions: Maintain minimum temperature of 40°F during and after installation of glazing materials.

## PART 2 - PRODUCTS

### 2.1 ALUMINUM WINDOWS

- A. Manufacturers:
  - 1. Architectural Window Manufacturing Corporation.
  - 2. Substitutions: As specified in Section 01 60 00 "Product Requirements."
- B. Description:
  - 1. Aluminum window units, sash, glass and glazing, infill panels.
  - 2. Aluminum Windows: Thermally broken with interior portion of frame insulated from exterior portion.



3. Glazing: Interior & Exterior.

C. Window Configuration:

1. Comply with AAMA 101.

D. Performance and Design Criteria:

1. Aluminum Windows: Meet minimum performance criteria for AAMA 101 Designation CW30 Commercial or better.
2. Design and size glass located less than 60'-0" above grade to withstand following windborne debris loads:
  - a. Glass within 30'-0" of Grade: Comply with ASTM E1886 and ASTM E1996; large-missile impact test.
  - b. Glass Greater Than 30 Feet above Grade: Comply with ASTM E1886 and ASTM E1996; small-missile impact test.
3. Wind Load Deflection: According to AAMA 101.
4. Assembly: Accommodate, without damage to components or deterioration of seals, movement between window and perimeter framing and deflection of lintel.
5. Vapor Seal: Test glass seal with interior atmospheric static pressure of 1", 140°F, and continuous UV and water spray exposure, without seal failure.
6. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, and migrating moisture occurring within system to exterior via weep drainage network.
7. Air Infiltration: Limit through assembly to 0.3 cfm/sq. ft. of wall area, measured at reference differential pressure across assembly of 1.57 psf and tested according to ASTM E283.
8. Thermal Performance:
  - a. Condensation Resistance Factor Class: Not less than C45 when measured according to AAMA 1503.
  - b. Thermal Transmittance of Assembly: Maximum U-value of 0.69 Btu/sq. ft. x h x °F when measured according to AAMA 1503.
9. Water Leakage: None, when measured according to ASTM E331 with test pressure difference as defined by AAMA 101.
10. Vapor Seal: Limit vapor seal with interior atmospheric static pressure of 1", 72°F, and 40% relative humidity, without seal failure.
11. Forced Entry Resistance: Comply with ASTM F588, Grade 10.

## 2.2 SUSTAINABILITY CHARACTERISTICS

### 2.3 COMPONENTS

A. Extruded Aluminum:

1. Description: 6063 alloy, T5 temper.
2. Comply with ASTM B221.

B. Insulating Glass:

1. Description: Sealed double-pane units as specified in Section 08 80 00 "Glazing."
2. Outer Pane: Low-E float glass.
3. Inner Pane: Clear float glass.

4. Pane Thickness: Minimum ¼”.
5. Minimum Total Unit Thickness: 1”.
6. Glazing Materials: Manufacturer's standard.

C. Single-Pane Glass:

1. Description: Single pane of clear float glass as specified in Section 08 80 00 “Glazing.”
2. Pane Thickness: Minimum ¼”.
3. Furnish fixed single pane with additional inner framed removable pane.
4. Glazing Materials: Manufacturer's standard.

D. Infill Panel:

1. Description: Internally reinforced, with glazing edge sealed permitting internal air movement to glazing space outside air barrier line.
2. Panel Sheet:
  - a. Material: Aluminum-faced sandwich panel.
  - b. Thickness: Minimum 1 inch.

## 2.4 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly while enabling installation and dynamic movement of perimeter seal.
- B. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive fabricated anchor devices.
- D. Arrange fasteners and attachments to ensure concealment from view.
- E. Prepare components with internal reinforcement for operating hardware.
- F. Drainage: Permit internal drainage weep holes and channels to migrate moisture to exterior.
- G. Glazing:
  1. Factory-glaze window units.
  2. Install glass and infill panels as specified in Section 08 80 00 “Glazing” using glazing method as required to achieve performance criteria.

## 2.5 FINISHES

- A. Coatings: Comply with AAMA 2603.
- B. Aluminum Surfaces:
  1. Manufacturer's standard thermosetting finish, with color as selected.
- C. Clear Anodized Aluminum Surfaces: AA-M12C22A41 nonspecular as fabricated mechanical finish, medium matte chemical finish, and Architectural Class I 0.7 mil.
- D. Apply one coat of bituminous paint on concealed aluminum surfaces in contact with cementitious or dissimilar materials.
- E. Galvanizing for Nuts, Bolts, and Washers: Comply with ASTM A153/A153M.

## 2.6 ACCESSORIES

- A. Fasteners and Anchors: Galvanized steel.
- B. Bituminous Paint: Fibered asphaltic type.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Section 01 77 00 "Closeout Procedures:" Requirements for installation examination.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.
- C. Verify that opening dimensions and clearances are properly sized to receive window units.

#### 3.2 INSTALLATION

- A. Comply with requirements of AAMA IPCB.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Align window plumb and level, free of warping or twisting.
- D. Maintain dimensional tolerances and alignment with adjacent Work.
- E. Thermal Barrier:
  - 1. Provide thermal isolation where components penetrate or disrupt building insulation.
  - 2. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- F. Coordinate attachment and seal of perimeter air barrier and vapor retarder materials.
- G. Perimeter Sealants: As specified in Section 07 90 00 "Joint Protection."

#### 3.3 TOLERANCES

- A. Section 01 40 00 "Quality Requirements:" Requirements for tolerances.
- B. Maximum Variation from Level or Plumb: 1/16"/3'-0" noncumulative, or 1/8"/10'-0", whichever is less.

#### 3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 "Quality Requirements:" Requirements for inspecting and testing.
- B. Inspection: Monitor quality of installation and glazing.
- C. Testing: Comply with AAMA 501.

#### 3.5 ADJUSTING

- A. Section 01 73 00 "Execution:" Requirements for starting and adjusting.
- B. Adjust hardware for smooth operation and for secure weathertight closure.

#### 3.6 CLEANING

- A. Section 01 77 00 "Closeout Procedures:" Requirements for cleaning.
- B. Remove protective material from factory-finished aluminum surfaces.
- C. Wash surfaces according to method recommended by and acceptable to sealant and window manufacturers; rinse and wipe surfaces clean.
- D. Remove excess sealant using moderate amounts of mineral spirits or other solvent acceptable to sealant and window manufacturers.

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

END OF SECTION 08 51 13

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

- 1. Mechanical and electrified door hardware for:
  - a. Swinging doors.
- 2. Electronic access control system components, including:
  - a. Electronic access control devices.
- 3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
- 4. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

- 1. Windows
- 2. Cabinets (casework), including locks in cabinets
- 3. Signage
- 4. Toilet accessories
- 5. Overhead doors

C. Related Sections:

- 1. Section 01 23 00 "Alternates" for alternates affecting this section.
- 2. Section 07 92 00 "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
- 3. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
- 4. Division 26 sections for connections to electrical power system and for low-voltage wiring.
- 5. Division 28 sections for coordination with other components of electronic access control system.

### 1.03 REFERENCES

- A. UL - Underwriters Laboratories
  - 1. UL 10B - Fire Test of Door Assemblies
  - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
  - 3. UL 1784 - Air Leakage Tests of Door Assemblies
  - 4. UL 305 - Panic Hardware
  
- B. DHI - Door and Hardware Institute
  - 1. Sequence and Format for the Hardware Schedule
  - 2. Recommended Locations for Builders Hardware
  - 3. Key Systems and Nomenclature
  
- C. ANSI - American National Standards Institute
  - 1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

### 1.04 SUBMITTALS

- A. General:
  - 1. Submit in accordance with Conditions of Contract and Division 01 requirements.
  - 2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
  - 3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.
  
- B. Action Submittals:
  - 1. Product Data: Technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
  - 2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
    - a. Wiring Diagrams: For power, signal, and control wiring and including:
      - 1) Details of interface of electrified door hardware and building safety and security systems.
      - 2) Schematic diagram of systems that interface with electrified door hardware.
      - 3) Point-to-point wiring.
      - 4) Risers.
  - 3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated, and tagged with full description for coordination with schedule.
    - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
  - a. Door Index; include door number, heading number, and Architects hardware set number.
  - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
  - c. Quantity, type, style, function, size, and finish of each hardware item.
  - d. Name and manufacturer of each item.
  - e. Fastenings and other pertinent information.
  - f. Location of each hardware set cross-referenced to indications on Drawings.
  - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
  - h. Mounting locations for hardware.
  - i. Door and frame sizes and materials.
  - j. Name and phone number for local manufacturer's representative for each product.
  - k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components).  
Operational description should include operational descriptions for: egress, ingress (access), and fire/smoke alarm connections.
    - 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.
5. Key Schedule:
  - a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
  - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
  - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
  - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
  - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
    - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
  - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

- C. Informational Submittals:
1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
  2. Product data for electrified door hardware:
    - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
  3. Warranty: Special warranty specified in this Section.
- D. Closeout Submittals:
1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
    - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    - b. Catalog pages for each product.
    - c. Factory order acknowledgement numbers (for warranty and service)
    - d. Name, address, and phone number of local representative for each manufacturer.
    - e. Parts list for each product.
    - f. Final approved hardware schedule, edited to reflect conditions as-installed.
    - g. Final keying schedule
    - h. Copies of floor plans with keying nomenclature
    - i. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
    - j. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

#### 1.05 QUALITY ASSURANCE

- A. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
1. Warehousing Facilities: In Project's vicinity.
  2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
  3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
  4. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
    - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- B. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC).



2. Can provide installation and technical data to Architect and other related subcontractors.
  3. Can inspect and verify components are in working order upon completion of installation.
  4. Capable of producing wiring diagrams.
  5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- C. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- D. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.
- G. Keying Conference
1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
    - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
    - b. Preliminary key system schematic diagram.
    - c. Requirements for key control system.
    - d. Requirements for access control.
    - e. Address for delivery of keys.
- H. Pre-installation Conference
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. Inspect and discuss preparatory work performed by other trades.
  3. Inspect and discuss electrical roughing-in for electrified door hardware.
  4. Review sequence of operation for each type of electrified door hardware.
  5. Review required testing, inspecting, and certifying procedures.
- I. Coordination Conferences:
1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
  2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
  - 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
  - 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
  - 2. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
  - 1. Promptly replace products damaged during shipping.
  - 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
  - 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- F. Deliver keys to Owner by registered mail or overnight package service.

#### 1.07 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

#### 1.08 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Beginning from date of Substantial Completion, for durations indicated.
  - a. Closers:
    - 1) Mechanical: **30 years.**
    - 2) Electrified: 2 years.
  - b. Exit Devices:
    - 1) Mechanical: 3 years.
    - 2) Electrified: 1 year.
  - c. Locksets:
    - 1) Electrified: 1 year.
  - d. Continuous Hinges: Lifetime warranty.
  - e. Key Blanks: Lifetime
2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

#### 1.09 MAINTENANCE

- A. Maintenance Tools: Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to insure continuity of existing and future performance and maintenance standards.
- B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

#### 2.02 MATERIALS

- A. Fasteners
  1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
  2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.

3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
  4. Install hardware with fasteners provided by hardware manufacturer.
- B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.
1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
  2. Use materials which match materials of adjacent modified areas.
  3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.
- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

## 2.03 HINGES

- A. Manufacturers and Products:
1. Scheduled Manufacturer and Product: Ives 5BB series.
  2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series, Stanley FBB Series.
- B. Requirements:
1. Provide hinges conforming to ANSI/BHMA A156.1.
  2. 1 $\frac{3}{4}$ " (44 mm) thick doors, up to and including 36" (914 mm) wide:
    - a. Exterior: Standard weight, bronze or stainless steel, 4 $\frac{1}{2}$ " (114 mm) high
    - b. Interior: Standard weight, steel, 4 $\frac{1}{2}$ " (114 mm) high
  3. 1 $\frac{3}{4}$ " (44 mm) thick doors over 36" (914 mm) wide:
    - a. Exterior: Heavy weight, bronze/stainless steel, 5" (127 mm) high
    - b. Interior: Heavy weight, steel, 5" (127 mm) high
  4. 2" or thicker doors:
    - a. Exterior: Heavy weight, bronze or stainless steel, 5" (127 mm) high
    - b. Interior: Heavy weight, steel, 5" (127 mm) high
  5. Provide three hinges per door leaf for doors 90" (2286 mm) or less in height, and one additional hinge for each 30" (762 mm) of additional door height.
  6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
  7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
    - a. Steel Hinges: Steel pins
    - b. Non-Ferrous Hinges: Stainless steel pins
    - c. Out-Swinging Exterior Doors: Non-removable pins
    - d. Out-Swinging Interior Lockable Doors: Non-removable pins

- e. Interior Non-lockable Doors: Non-rising pins
- 8. Width of hinges: 4½” (114 mm) at 1¾” (44 mm) thick doors, and 5” (127 mm) at 2” (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
- 9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
- 10. Provide mortar guard for each electrified hinge specified.
- 11. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90” (2286 mm) or less in height. Provide one additional bearing hinge for each 30” (762 mm) of additional door height.

## 2.04 ELECTRONIC ACCESS CONTROL LOCKSETS – WIRELESS BORED-TYPE

### A. Manufacturers:

- 1. Scheduled Manufacturer: To establish standard of quality and design intent, wireless access control bored-type locksets specifications have been based on Schlage NDE series. Products of other manufacturers meeting or exceeding design and performance requirements specified herein will be considered for substitution subject to compliance with provisions of Division 01 Section “Product Requirements.”

### B. Product: Schlage ND Series wireless bored-type electronic locksets conforming to the following requirements:

- 1. ANSI/BHMA A156.2 Series 4000, Grade 1.
- 2. Florida Building Code (ASTM E330, E1886, E1996) and Miami Dade (TAS 201, 202, 203) requirements for hurricanes.
- 3. Certified to UL10C 3 hour rating, ULC-S319, FCC Part15, ADA RoHS, ICC ANSI A117.1
- 4. Listed, UL 294 - The Standard of Safety for Access Control System Units.
- 5. Compliant with ANSI/BHMA A156.25 Operation and Security interior operating range of 32°F (0°C) to 120°F (49°C) for interior use only.
- 6. Compliant with ASTM E330 for door assemblies.
- 7. Compliant with ICC / ANSI A117.1, NFPA 101, NFPA 80 and IBC Chapter 10 Cylinders: Refer to “KEYING” article, herein.
- 8. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
  - a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
  - b. Offset lever pull – minimum 1,600 foot pounds without gaining access
  - c. Vertical lever impact – minimum 100 impacts without gaining access
  - d. Cycle Test - tested to minimum 16 million cycles with no visible lever sag or use of performance aids such as set screws or spacers.
- 9. Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
- 10. Functions: Provide storeroom function.

11. Emergency Override: Provide mechanical key override; cylinders: Refer to “KEYING” article, herein.
12. Levers:
  - a. Vandal Resistance: Exterior (secure side) lever rotates freely while door remains locked, preventing damage to internal locking components from vandalism by excessive force.
  - b. Provide lever trim that operates independently of each other.
  - c. Style: **ATH**.
13. Power Supply: 4 AA batteries
  - a. Provide battery powered wireless electronic products with the ability to communicate battery status and battery voltage level by means of a mobile app at door and remotely by Partner integrated software.
14. Features:
  - a. Ability to communicate unit’s communication status.
  - b. Visual LED indicators that indicate activation, operational systems status, system error conditions and low power conditions.
  - c. Audible feedback that can be enabled or disabled.
15. Switches:
  - a. Door Position Sensor – magnet integrated into strike to eliminate additional door prep
  - b. Interior Cover Tamper Guard
  - c. Battery Status
  - d. Request to Exit
16. Credential Reader:
  - a. Credential Reader Configuration: Provide credential reader modules in the following configurations, as scheduled.
    - 1) Proximity, Smartcard via Multi-Technology reader.
  - b. Credential reader capabilities:
    - 1) 13.56 MHz Smart card credentials:
      - a) Secure section (Multi-Technology and Smartcard): aptiQ MIFARE Classic, aptiQ MIFARE DESFire EV1
      - b) 13.56 MHz Serial number only (Multi-Technology and Smartcard): DESFire CSN, HID iCLASS CSN, MIFARE CSN, MIFARE DESFire EV1 CSN
    - 2) 125 kHz Proximity card credentials: Schlage, XceedID, HID, GE/CASI, AWID
    - 3) Multi-Technology readers that read both 13.56 MHz Smart Cards and 125 kHz Prox cards on a battery powered device.
17. Operation: Provide battery powered wireless electronic products able to operate in three possible modes without change to lock hardware.
  - a. Manual operation – Updates pulled direct from mobile app via BLE when in range of up to 50 feet from mobile device to wireless electronic product.
  - b. Daily operation –
    - 1) Updates request by wireless electronic product within 24 hours over Wi-Fi communication, Wi-Fi connection required at the wireless electronic product.
    - 2) Can be managed by external software.

- c. Real-time operation
  - 1) Updates communicated in real-time via 2.4 GHz communication to gateway in less than 5 seconds.
  - 2) Wireless electronic products will be connected via integrated 3<sup>rd</sup> party software.
  - 3) Wireless electronic products to have real-time bidirectional communication between access control system and wireless electronic products in less than 5 seconds.
- d. Remote Commanding by Partner Integrated Access Control Network Software with Real-time operation: Provide battery powered wireless electronic products with wireless gateway allowing activation of remote, wireless access control products, enabling activated wireless electronic products to be locked or unlocked from a centralized location within 5 seconds or less without user interface at the device.
- e. Upon Loss of Power to Wireless Electronic Products: Provide battery powered wireless electronic products able to manage access control offline in one of three methods below that can be configured in the field at wireless electronic product by mobile app and remotely by Partner integrated software:
  - 1) Fail locked (secured)
  - 2) Fail unlocked (unsecured)
  - 3) Fail As-Is
- f. Upon Loss of Communication Between Wireless Electronic Products and Gateway with Internet Protocol connection to Host for Real-time operation: Provide battery powered wireless electronic products able to manage access control offline with self-contained database inside device until communication can be re-established between Wireless Electronic Product and Host via Gateway.
  - 1) Wireless electronic product manages access offline with up to 5,000 users and access schedules as provided by Host prior to loss of communication
  - 2) Wireless electronic product captures up to 2,000 audit events from time of communication loss with Host. Audits are transferred to Host upon reconnection of communication via Gateway.
- g. Upon Loss of Communication Between Wireless Electronic Products and Gateway with RS-485 connection to Access Control Panel or Host for Real-time operation: Provide battery powered wireless electronic products able to manage access control offline in one of four methods below that can be configured in the field at wireless electronic product by mobile app and remotely by Partner integrated software:
  - 1) Fail locked (secured)
  - 2) Fail unlocked (unsecured)
  - 3) Fail As-Is
  - 4) Fail to Degraded/cache mode utilizing cache memory with following selectable options:
    - a) Grant access up to the last 1,000 unique previously accepted User IDs.
    - b) Grant access up to the last 1,000 unique previously accepted facility/site codes
    - c) Remove from cache previously stored User IDs or facility/site codes that have not been presented to wireless electronic product within the last 5 days.
- h. Provide battery powered wireless electronic products able to be remotely configured and managed with Web App, Mobile App, or Partner integrated software.

- i. Provide battery powered wireless electronic products able to communicate identifying information such as firmware versions, hardware versions, serial numbers, and manufacturing dates by mobile app and remotely by Partner integrated software.
- j. Wireless Transmission:
  - 1) Bluetooth Low Energy (BLE)
  - 2) Wi-Fi 802.11 B & G
- k. Data Encryption
  - 1) Encryption: AES 256-bit Key minimum – all BLE communication is AES 256-bit encryption minimum
  - 2) TLS encryption –
    - a) Wireless Electronic Product to Cloud – Daily Mode
    - b) Gateway to Cloud - Real Time Mode

### C. Components

1. Product: Allegion Engage Mobile App.
  - a. Provide Mobile App for wireless electronic access control products capable of the following minimum requirements.
    - 1) Add and Configure wireless electronic access control products.
    - 2) Send updates to wireless electronic access control products.
    - 3) Add new users and enroll credentials to wireless electronic access control products.
    - 4) View audits and alerts by wireless electronic access control product.
    - 5) Perform diagnostics of wireless electronic access control products.
  - b. System Requirements: mobile devices, provided by others, require one of the following operating systems.
    - 1) IOS 7.1 or later
    - 2) Android 4.4, Kit Kat, or later
    - 3) Capable of using Allegion Engage Mobile App
  - c. Mobile App capable of field configuring electronic access control devices for the following minimum attributes.
    - 1) Credential reader formats
    - 2) Unlock Period
    - 3) Power failure mode
    - 4) Audible alarm ON/OFF
    - 5) Battery status
    - 6) Validate hardware and software revision
    - 7) Troubleshooting status signals
    - 8) Door propped open delay
2. Product: Allegion Engage Web App.
  - a. Provide Web App for wireless electronic access control products capable of the following minimum requirements.
    - 1) Configure wireless electronic products
    - 2) Add new users and enroll credentials
    - 3) View audits and alerts by door



- b. System Requirements: computers or other devices, provided by others, require the one of the following browsers.
  - 1) Internet Explorer 9.0 or later
  - 2) Chrome 33.0 or later
  - 3) Firefox 28.0 or later
  - 4) Safari 7.0 or later
- 3. Product: Gateway
  - a. Provide Gateway for Real-time operation between wireless electronic access control products and Host system that meets the following requirements.
    - 1) Supports real-time communications to wireless electronic access control product.
    - 2) Communicates between gateway and host by RS-485, Ethernet (IP/PoE).
    - 3) Supports up to 10 wireless electronic access control products.
    - 4) Performs lockdown/unlock command from host to wireless electronic access control product within 5 seconds.
    - 5) Capable of receiving remote firmware upgrades by mobile app.
    - 6) Capable of updating the firmware on a linked wireless electronic product.
    - 7) Capable of being powered over Ethernet (PoE) or via an external 12/24 VDC power supply.
    - 8) Supports a remote antenna to extend reach of wireless signal to wireless electronic access control product.
    - 9) Communicates secured data between the gateway and wireless electronic access control products.

## 2.05 CYLINDERS

### A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Schlage Everest 29 R.
- 2. Approved Equal.

### B. Requirements:

- 1. Provide cylinders/cores, from the same manufacturer of locksets, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
- 2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
  - a. Conventional Patented Restricted Small Format: cylinder with small format interchangeable cores (SFIC) with restricted, patented keyway.
- 3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent-protected until the year, 2029.
- 4. Nickel silver bottom pins.

### C. Construction Keying:

- 1. Replaceable Construction Cores.
  - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
    - 1) 3 construction control keys
    - 2) 12 construction change (day) keys.

- b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

## 2.06 KEYING

- A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Provide cylinders/cores keyed into Owner's existing factory registered keying system.
- C. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- D. Requirements:
  1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
    - a. Master Keying system as directed by the Owner.
  2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
  3. Provide keys with the following features:
    - a. Material: Nickel silver; minimum thickness of .107" (2.3mm)
    - b. Patent Protection: Keys and blanks protected by one or more utility patent(s) until the year, 2029.
  4. Identification:
    - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Do not provide blind code marks with actual key cuts.
    - b. Identification stamping provisions must be approved by the Architect and Owner.
    - c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
    - d. Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
    - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
  5. Quantity: Furnish in the following quantities.
    - a. Change (Day) Keys: 3 per cylinder/core.
    - b. **SFIC**: Permanent Control Keys: 3.
    - c. Master Keys: 6.

## 2.07 DOOR CLOSERS

- A. Manufacturers and Products:
  1. Scheduled Manufacturer and Product: LCN 1460 series.
  2. Acceptable Manufacturers and Products: Corbin-Russwin DC6000 series.
  3. Approved Equal.

**B. Requirements:**

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action cast iron cylinder.
3. Closer Body: 1¼" (32 mm) diameter, with ⅝" (16 mm) dia. heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120°F to -30°F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

**2.08 PROTECTION PLATES****A. Manufacturers:**

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

**B. Requirements:**

1. Provide kick plates, mop plates, and armor plates minimum of 0.050" (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
  - a. Kick Plates: 10" (254 mm) high by 2" (51 mm) less width of door on single doors, 1" (25 mm) less width of door on pairs
  - b. Mop Plates: 4" (102 mm) high by 2" (51 mm) less width of door on single doors, 1" (25 mm) less width of door on pairs
  - c. Armor Plates: 36" (914 mm) high by 2" (51 mm) less width of door on single doors, 1" (25 mm) less width of door on pairs

**2.09 DOOR STOPS AND HOLDERS****A. Manufacturers:**

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

**B. Provide door stops at each door leaf:**

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

## 2.10 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

### A. Manufacturers:

1. Scheduled Manufacturer: Zero International.
2. Acceptable Manufacturers: National Guard, Reese.

### B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Size of thresholds:
  - a. Saddle Thresholds: ½" (13 mm) high by jamb width by door width
  - b. Bumper Seal Thresholds: ½" (13 mm) high by 5" (127 mm) wide by door width
4. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

## 2.11 FINISHES

### A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 630 (US32D)
3. Continuous Hinges: BHMA 628 (US28)
4. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
5. Protection Plates: BHMA 630 (US32D)
6. Overhead Stops and Holders: BHMA 630 (US32D)
7. Door Closers: Powder Coat to Match
8. Wall Stops: BHMA 630 (US32D)
9. Latch Protectors: BHMA 630 (US32D)
10. Weatherstripping: Clear Anodized Aluminum
11. Thresholds: Mill Finish Aluminum

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Where on-site modification of doors and frames is required:
  - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
  - 2. Field modify and prepare existing door and frame for new hardware being installed.
  - 3. When modifications are exposed to view, use concealed fasteners, when possible.
  - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
    - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

### 3.03 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  - 2. Custom Steel Doors and Frames: HMMA 831.
  - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30" (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
  - 1. Replace construction cores with permanent cores as indicated in keying section.

- I. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- J. Closer/holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- K. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- L. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

### 3.04 FIELD QUALITY CONTROL

- A. Engage qualified manufacturer trained representative to perform inspections and to prepare inspection reports.
  - 1. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### 3.05 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.
  - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

### 3.06 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

### 3.07 DOOR HARDWARE SCHEDULE

- A. Hardware items are referenced in the following hardware. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Hardware Sets:

HARDWARE GROUP NO. 01

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDE80HD ATH BATTERY OPERATED PROVIDED BY SECURITY	626	SCE
1	EA	SFIC EVEREST CORE	80-037 CKC EV29 R	626	SCH
1	EA	SURFACE CLOSER	1461 EDA FC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Operational description:

1. Door normally closed and locked.
2. Entry by valid credential at card reader which signals electric trim of lock to open and allow entry.
3. Free egress at all times via the inside lever handle.
4. Inside lever handle has rx switch which will signal access control system of a valid release.
5. Lock is fail-secure upon loss of power door will remain locked.

HARDWARE GROUP NO. 02

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDE80HD ATH BATTERY OPERATED PROVIDED BY SECURITY	626	SCE
1	EA	SFIC EVEREST CORE	80-037 CKC EV29 R	626	SCH
1	EA	SURFACE CLOSER	1461 RW/PA FC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Operational description:

1. Door normally closed and locked.
2. Entry by valid credential at card reader which signals electric trim of lock to open and allow entry.
3. Free egress at all times via the inside lever handle.
4. Inside lever handle has rx switch which will signal access control system of a valid release.
5. Lock is fail-secure upon loss of power door will remain locked.

HARDWARE GROUP NO. 03

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDE80HD ATH BATTERY OPERATED PROVIDED BY SECURITY	626	SCE
1	EA	SFIC EVEREST CORE	80-037 CKC EV29 R	626	SCH
1	EA	CUSTOM STRIKE	SIZE AS REQUIRED FOR EXISTING FRAME	626	ACC
1	EA	RE-USE	BALANCE OF EXISTING HARDWARE		

GC TO RE-WORK EXISTING DOOR & FRAME AS REQUIRED FOR NEW HARDWARE

Operational description:

1. Door normally closed and locked.
2. Entry by valid credential at card reader which signals electric trim of lock to open and allow entry.
3. Free egress at all times via the inside lever handle.
4. Inside lever handle has rx switch which will signal access control system of a valid release.
5. Lock is fail-secure upon loss of power door will remain locked.

HARDWARE GROUP NO. 04

Provide each SGL door(s) with the following:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDE80HD ATH BATTERY OPERATED PROVIDED BY SECURITY	626	SCE
1	EA	SFIC EVEREST CORE	80-037 CKC EV29 R	626	SCH
1	EA	SURFACE CLOSER	1461 RW/PA FC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Operational description:

1. Door normally closed and locked.
2. Entry by valid credential at card reader which signals electric trim of lock to open and allow entry.
3. Free egress at all times via the inside lever handle.
4. Inside lever handle has rx switch which will signal access control system of a valid release.
5. Lock is fail-secure upon loss of power door will remain locked.

END OF SECTION 08 71 00



SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the glass and glazing as shown on the drawings and/or specified herein, including, but not limited to, glazing of the following:
  - 1. Doors.

1.3 RELATED SECTIONS

- A. Section 08 11 13 "Hollow Metal Frames."

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thicknesses indicated on drawings and/or specified herein are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat-treated) required to meet or exceed the following criteria:
  - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
    - a. Specified Design Wind Loads: 30 psf or greater if required by Code.
  - 2. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15° off vertical and under wind action.
    - a. Load Duration: 60 seconds or less.
  - 3. Maximum Lateral Deflection: For glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/100 times the short side length or 3/4", whichever is less.
  - 4. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

- a. Temperature Change (Range): 120°F ambient; 180°F, material surfaces.
- C. Glass units shall be annealed, heat strengthened, or fully tempered where required to meet wind load and safety glazing requirements, as shown, specified, or recommended by the glass fabricator, and as required by the prevailing Building Code.

## 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
- B. Verification Samples: Submit representative samples of each glass and glazing material that is to be exposed in completed work. Show full color ranges and finish variations expected. Provide glass samples having minimum size of 144 sq. in. and 6" long samples of sealants and glazing materials; all samples shall bear the name of the manufacturer, brand name, thickness, and quality.
- C. Calculations: Provide wind load charts, calculations and certification of performance of this work. Indicate how design requirements for loading and other performance criteria have been satisfied.
- D. Test Reports: Provide certified reports for specified tests.
- E. Warranties: Provide written warranties as specified herein.

## 1.6 QUALITY ASSURANCE

- A. Source: For each glass and glazing type required for work of this Section, provide primary materials which are products of one manufacturer. Provide secondary or accessory materials which are acceptable to manufacturers of primary materials.
- B. Installer: A firm with a minimum of five years' experience in type of work required by this Section and which is acceptable to manufacturers of primary materials; and with a successful record of in-service installations similar in size and scope to this Project.
- C. Glass Thickness: Glass thicknesses shown on drawings and/or specified herein are minimum thicknesses. Determine and provide size and thickness of glass products that are certified to meet or exceed performance requirements specified in this Section. Provide units with proper thickness, edge clearance and tolerance to comply with recommendations of glass manufacturer.
- D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated.
  1. GANA Publications: GANA'S "Glazing Manual."
  2. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines for Sealed Insulating Glass Units."
- E. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and 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 252.
- F. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
  1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council.
  2. Where glazing units, including Kind FT glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side,

provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

- G. Insulating Glass Certification Program: Permanently marked on spacers with appropriate certification label of the following testing and inspecting agency:
1. Insulating Glass Certification Council.
  2. Associated Laboratories, Inc.

## 1.7 TESTS

- A. Preconstruction Sealant Test: Submit samples of materials to be used to glazing sealant manufacturer to determine sealant compatibility. Include samples of glass, gaskets, glazing materials, framing members, and other components and accessories of glazing work. Test in accordance with ASTM C 794 to verify what type of primers (if any) are required to ensure sealant adhesion to substrates.
1. Submit minimum of nine pieces of each type and finish of framing member, and nine pieces of each type, class, kind, condition, and form of glass, including monolithic and insulating glass for adhesion tests.
  2. Provide manufacturer's written report and recommendations regarding proper installation.

## 1.8 PROJECT CONDITIONS

- A. Weather: Perform work of this Section only when existing or forecasted weather conditions are within limits established by manufacturers of materials and products used.
- B. Temperature Limits: Install sealants only when temperatures are within limits recommended by sealant manufacturer, except, never install sealants when temperatures are below 40°F.

## 1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations and GANA Manual.
1. Protect materials from moisture, sunlight, excess heat, sparks and flame.
  2. Sequence deliveries to avoid delays, but minimize on-site storage.

## 1.10 WARRANTIES

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. Manufacturer's Special Project Warranty on Coated Glass Products: Provide written warranty signed by manufacturer of coated glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, replacements for those coated glass units which develop manufacturing defects. Manufacturing defects are defined as peeling, cracking or deterioration in metallic coating due to normal conditions and not due to handling or installation or cleaning practices contrary to glass manufacturer's published instructions.
1. Warranty Period: Manufacturer's standard but not less than five (5) years after date of substantial completion.

- C. Manufacturer's Special Project Warranty on Insulating Glass: Provide written warranty signed by manufacturer of insulating glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, replacements for those insulating glass units developing manufacturing defects. Manufacturing defects are defined as failure or hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance; provided the manufacturer's instructions for handling, installing, protecting and maintaining units have been complied with during the warranty period.
1. Warranty Period: Manufacturer's standard but not less than ten (10) years after date of substantial completion.

## PART 2 PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS/FABRICATORS

- A. All glass and glazing used at the exterior of the Project shall be manufactured by the same manufacturer. The same manufacturer and the same furnace shall be used for all tempered and heat strengthened glass used throughout the project.

### 2.2 GLASS MATERIALS AND PRODUCTS

- A. Clear Float Glass: ASTM C 1036, Type I (Transparent), Flat, Class 1 (Clear), Quality q3, minimum 1/4" thick.
- B. Clear Tempered Glass: ASTM C 1048, Condition A (Uncoated), Type I (Transparent), Flat, Class 1 (Clear), Quality q3, Kind FT, minimum 1/4" thick.
- C. Low 'E' Coated Glass: Provide high-performance, clear, metallic coating, Solarscreen 2000, as manufactured by Viracon. Provide Low 'E' coating which has the following performance characteristics when applied to the No. 2 surface of 1" insulating units, both lites 1/4" clear:
1. Visible Light Transmittance: 70%.
  2. Shading Coefficient: 0.43.
  3. Solar Energy Transmittance: 32%.
- D. Insulating Glass: Provide factory assembled units of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space, complying with ASTM E 774-97, and as follows:
1. Sealing System: Dual Seal.
  2. Primary Sealant: Polyisobutylene.
  3. Secondary Sealant: Silicone, General Electric IGS 3204 or IGS 3100, Rhodorsil Rhodortherm 542 or 543, or Dow Corning 982.
  4. Spacer: Clear finish aluminum with welded, soldered, or bent corners.
  5. Desiccant: Molecular sieve, silica gel, or blend of both.
  6. Air Space Thickness: 1/2".
  7. Glass Thickness: 1/4" minimum.
- E. Fire-Rated Glazing Material: Proprietary product in the form of clear flat sheets of 3/16" nominal thickness weighing 2.5 lb./sq. ft., and as follows:

1. Fire Protection Rating: As required by Code for the fire rated opening in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Product: "Premium FireLite" by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products.

### 2.3 GLAZING MATERIALS AND PRODUCTS

- A. General: Provide sealants and gaskets with performance characteristics suitable for applications indicated. Ensure compatibility of glazing sealants with insulating glass sealants and with any other surfaces in contact.
- B. General Glazing and Cap Bead Sealant: Provide sealant with maximum Shore A hardness of 50. Provide one of the following:
  1. Dow Corning 795.
  2. General Electric Silglaze N 2500 or Contractors SCS-1000.
  3. Rhodorsil 3B, 5C, or 6B.
  4. Tremco Spectrem 2.
- C. Weather Seal Sealant: Provide non-acid curing sealant with movement range  $\pm 50\%$ , ASTM C 719. Provide one of the following:
  1. Dow Corning 795.
  2. General Electric Silpruf.
  3. Rhodorsil 3B, 5C, or 6B.
  4. Tremco Spectrem 2.
- D. Dense Elastomeric Compression Seal Gaskets: Provide molded or extruded neoprene or EPDM gaskets, Shore A hardness of  $75\pm 5$  for hollow profile, and  $60\pm 5$  for solid profiles, ASTM C 864.
- E. Cellular, Elastomeric Preformed Gaskets: Provide extruded or molded closed cell, integral-skinned neoprene, Shore A  $40\pm 5$ , and 20% to 35% compression, ASTM C 509; Type II.
- F. Preformed Glazing Tape: Provide solvent-free butyl-polyisobutylene rubber with 100% solids content complying with ASTM C 1281 AAMA A 800 with integral continuous EPDM shim. Provide preformed glazing tape in extruded tape form. Provide Tremco "Polyshim II" or approved equal.
- G. Setting Blocks: Provide neoprene or silicone blocks with Shore A hardness of 80-90. Provide products certified by manufacturer to be compatible with silicone sealants. Length to be not less than 4". Width for setting blocks to be 1/16" more than glass thickness and high enough to provide the lite recommended by glass manufacturer. When thickness of setting block exceeds 3/4" the glass manufacturer must be consulted for sizes and configuration. In a vented system, setting block shall be designed so as to not restrict the flow of water within the glazing rabbet to the weep holes.
  1. Shims: For shims used with setting blocks, provide same materials, hardness, length and width as setting blocks.
  2. Structural Silicone Glazing: Provide silicone setting blocks where structural silicone occurs at sills and at insulating units with silicone edge seals.
- H. Edge Blocks: Provide neoprene or silicone as required for compatibility with glazing sealants. Provide blocks with Shore A hardness of  $55\pm 5$ .

- I. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place.
- J. Miscellaneous Glazing Materials: Provide sealant backer rods, primers, cleaners, and sealers of type recommended by glass and sealant manufacturers.

## 2.4 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze 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 standard, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.
- C. Grind smooth and polish exposed glass edges.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine framing glazing, 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 system.
  - 3. Minimum required face or 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.

### 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. Glazing channel dimensions, as indicated on Shop Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

- E. 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.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where the length plus width is larger than 50" as follows:
  - 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" 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.
- H. 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.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- 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.
- L. Flush Glazing
  - 1. If the butt joint in the metal framing is in the vertical direction, the glazier shall run the tape initially on the head and sill members going directly over this joint. Should the butt joint in the metal framing run horizontally, tapes must first be applied to the jambs so that it crosses over the joint.
  - 2. Each tape section shall butt the adjoining tape and be united with a tool to eliminate any opening.
  - 3. Do not overlap the adjoining length of tape or rubber shim as this will prevent full contact around the perimeter of glass.
- M. Off-Set Glazing
  - 1. Where the glazing legs are off-set, the difference in the rabbet width shall be compensated by employing different glazing tapes with different diameter shims. The difference in shim shall be equal to the size of the off-set. The thinner tape shall be positioned first on the glazing leg closest to the interior. The thicker tape shall be cut to the exact length of the dimension between the applied tapes, and installed on the outermost glazing leg.
  - 2. Immediately prior to setting glass, paper backing shall be removed. Apply a toe bead of sealant 6" in each direction, from each corner.
  - 3. Locate setting blocks in the sill member at quarter points, or if necessary to within 6" of each corner. Setting blocks must be set equal distance from center line of the glass and high enough to provide the recommended bite and edge clearances.
  - 4. Set edge block according to glass manufacturer's recommendations.
  - 5. Set Glass: The glass shall be pressed firmly against the tape to achieve full contact.
  - 6. In a vented system, apply a heel bead (air seal) of sealant around the perimeter of glass, between the sole of the I.G. unit and the base of the rabbet of the metal framing developing a positive bond to the unit and to the metal framing. The bead of the sealant shall be deep

enough so that it will partially fill the channel to a depth of ¼” between the glass edge and the base of the metal framing rabbet.

7. Interior stops shall be set, and glazing tape spline for the appropriate face clearance shall be rolled into place, compressing the glass to the shim within the glazing tape.

### 3.4 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. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these 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 just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant as recommended by glass manufacturer or glass frame manufacturer.
- G. 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.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape where noted on approved shop drawings.

### 3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance 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. 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. Install gaskets so they protrude past face of glazing stops.

### 3.6 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.



### 3.7 PROTECTION AND CLEANING

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. 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 build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

### 3.8 SCHEDULE

- A. Glazing type 'A': 1" Nominal Thickness Insulated Glass Units Fully Tempered with security film. 2 sheets of 1/4" thick fully tempered float glass complying with requirements for ASTM C 1048, FT (fully tempered) Quality q3. Separated by 1/2" air-space. Double Sealed with a secondary seal of silicone. 10 year manufacturers warranty against seal failure providing installation is in accordance with Glass Association of North America (GANA).

Exterior Lite    1/4" Clear Tempered  
                         1/2" Air-Space (Silver anodized aluminum)  
Interior Lite    1/4" Low-e #3 Tempered with security film on airspace side

END OF SECTION 08 80 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstructural metal stud wall framing.
2. Metal channel ceiling framing.
3. Gypsum board and finishing.
4. Shaft wall system.
5. Gypsum coreboard.
6. Gypsum base for plaster.
7. Predecorated gypsum board.
8. Cementitious backer board.
9. Acoustic insulation.
10. Textured finishes.

B. Related Requirements:

1. Section 05 40 00 "Cold-Formed Metal Framing:" Building light-gage metal framing system and sheathing.
2. Section 06 10 53 "Miscellaneous Rough Carpentry:" Wood blocking.

1.2 REFERENCE STANDARDS

A. American Society of Civil Engineers:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International:

1. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
2. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.
3. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
4. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
5. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
6. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
7. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
8. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
9. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

10. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.
11. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
12. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets.
13. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.
14. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
15. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
16. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
17. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
18. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
19. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
20. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

C. California Department of Public Health:

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.

D. Gypsum Association:

1. GA-214 - Recommended Levels of Gypsum Board Finish.
2. GA-216 - Application and Finishing of Gypsum Panel Products.
3. GA-600 - Fire Resistance Design Manual.

E. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

F. National Fire Protection Association:

1. NFPA 265 - Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls.
2. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

G. South Coast Air Quality Management District:

1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

H. Underwriters Laboratories Inc.:

1. UL - Fire Resistance Directory.

### 1.3 PREINSTALLATION MEETINGS

- A. Section 01 30 00 "Administrative Requirements:" Requirements for pre-installation meeting.
- B. Convene minimum one week prior to commencing Work of this Section.

#### 1.4 SUBMITTALS

- A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
- B. Product Data: Submit manufacturer's information on metal framing, gypsum board, finishing, backer boards, decorative finishes, and acoustic accessories.
- C. Shop Drawings:
  - 1. Indicate special details associated with fireproofing, acoustic seals, and pre-decorated gypsum board.
  - 2. Indicate installation details required for seismic design loads.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for stud thicknesses, acoustic attenuation, and seismic loads.
- F. Qualifications Statement:
  - 1. Submit qualifications for manufacturer, installer, and licensed professional.

#### 1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 “Sustainable Design Requirements:” Requirements for sustainable design submittals.
- B. Manufacturer's Certificate:
  - 1. Certify that products meet or exceed specified sustainable design requirements.
  - 2. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for regional materials and distance from Project Site.
  - 3. Indoor Air Quality Certificates:
    - a. Certify VOC content for each interior adhesive, sealant, and related primer.
    - b. Certify VOC content for each ceiling and wall system.
- C. Product Cost Data:
  - 1. Submit cost of products to verify compliance with Project sustainable design requirements.
  - 2. Exclude cost of labor and equipment to install products.
  - 3. Provide cost data for following products:
    - a. Products with recycled material content.
    - b. Regional products.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work according to ASTM C840.
- B. Fire-Rated Wall, Floor, and Roof Construction:
  - 1. Rating:
    - a. As indicated on Drawings.
  - 2. Testing: Comply with ASTM E119.
- C. Surface-Burning Characteristics:
  - 1. Wall Coverings:

- a. Maximum Flame-Spread/Smoke-Developed Index: 25/450, when tested according to ASTM E84.
  - b. Requirements of applicable code when tested according to NFPA 265, Method B test protocol.
  - c. Requirements of applicable code when tested according to NFPA 286.
- D. Perform Work according to applicable standards.
- E. Maintain one copy of each standard affecting Work of this Section on Site.

#### 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.
- C. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of New Jersey.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 "Product Requirements:" Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Provide additional protection according to manufacturer instructions.

#### 1.9 AMBIENT CONDITIONS

- A. Section 01 50 00 "Temporary Facilities and Controls:" Requirements for ambient condition control facilities for product storage and installation.
- B. Maintain temperature at not less than 40°F for the mechanical application of gypsum board unless otherwise recommended by manufacturer.
- C. Maintain temperature at not less than 50° F for the adhesive application of gypsum board, and for field finishing and texturing, unless otherwise recommended by manufacturer.

### PART 2 - PRODUCTS

#### 2.1 GYPSUM BOARD ASSEMBLIES

- A. Manufacturers:
  - 1. American Gypsum Co.
  - 2. G-P Gypsum Corp.
  - 3. National Gypsum Company
  - 4. United States Gypsum Co.
  - 5. Substitutions: As specified in Section 01 60 00 "Product Requirements."

- B. Performance and Design Criteria:
  - 1. Stud Framing: Resist minimum 5-psf uniform load and maximum 1/720 deflection.
  - 2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated according to ASCE 7 and applicable codes.

## 2.2 MATERIALS

- A. Framing:
  - 1. Studs and Tracks:
    - a. Comply with ASTM C645.
    - b. Material: Galvanized sheet steel.
    - c. Thickness: As indicated on Drawings.
    - d. Shape: C.
    - e. Depth: As indicated on Drawings.
    - f. Faces: Knurled.
  - 2. Shaft Wall Studs and Accessories:
    - a. Comply with ASTM C645.
    - b. Material: Galvanized sheet steel.
    - c. Thickness: As indicated on Drawings.
    - d. Shape: I, CH, CT
    - e. Depth: As indicated on Drawings.
  - 3. Furring and Accessories:
    - a. Comply with ASTM C645.
    - b. Material: Galvanized sheet steel.
    - c. Thickness: As indicated on Drawings.
    - d. Shape: As indicated on Drawings.
    - e. Depth: As indicated on Drawings.
- B. Gypsum Board:
  - 1. Comply with ASTM C1396/C1396M.
    - a. Furnish Type X, fire-resistant type, throughout.
  - 2. Standard Gypsum Board:
    - a. Thickness: As indicated on Drawings.
    - b. Length: Maximum available in place.
    - c. Weight: Standard.
    - d. Ends: Square cut.
    - e. Edges: Tapered.
  - 3. Moisture-Resistant Gypsum Board:
    - a. Thickness: As indicated on Drawings.
    - b. Length: Maximum available in place.
    - c. Ends: Square cut.
    - d. Edges: Tapered.
    - e. Mold/Mildew Resistance: 10 in scale of one to 10; ASTM D3273.
  - 4. Abuse-Resistant Gypsum Board:

- a. Thickness:  $\frac{5}{8}$ ".
  - b. Length: Maximum available in place.
  - c. Ends: Square cut.
  - d. Edges: Tapered.
  - e. Surface Abrasion Resistance: Classification Level 3; ASTM C1629/C1629M.
  - f. Indentation Resistance: Classification Level 1; ASTM C1629/C1629M.
  - g. Soft-Body Impact Resistance: Classification Level 2; ASTM C1629/C1629M.
  - h. Hard-Body Impact Resistance: Classification Level 1; ASTM C1629/C1629M.
5. Impact-Resistant Gypsum Board:
- a. Thickness:  $\frac{5}{8}$ ".
  - b. Length: Maximum available in place.
  - c. Ends: Square cut.
  - d. Edges: Tapered.
  - e. Surface Abrasion Resistance: Classification Level 3, ASTM C 1629/C1629M.
  - f. Indentation Resistance: Classification Level 1, ASTM C 1629/C1629M.
  - g. Soft-Body Impact Resistance: Classification Level 3, ASTM C1629/C1629M.
  - h. Hard-Body Impact Resistance: Classification Level 3, ASTM C 1629/C1629M.
6. Acoustically Enhanced Gypsum Board:
- a. Thickness: As indicated on Drawings.
  - b. Length: Maximum available in place.
  - c. Ends: Square cut.
  - d. Edges: Tapered.
  - e. Core: Manufacturer's proprietary laminated construction to achieve high-level acoustic requirements with minimum thickness.
    - 1) Inner Layer: Viscoelastic damping polymer.
    - 2) Outer Layers: Enhanced, high-density mold-resistant gypsum core.
7. Exterior Gypsum Soffit Board:
- a. Thickness: As indicated on Drawings.
  - b. Length: Maximum available in place.
  - c. Ends: Square cut.
  - d. Edges: Tapered and beveled.
8. Foil-Backed Gypsum Board:
- a. Thickness: As indicated on Drawings.
  - b. Length: Maximum available in place.
  - c. Protection: Back surface laminated with aluminum foil.
  - d. Ends: Square cut.
  - e. Edges: Tapered and beveled.
9. Gypsum Base:
- a. Thickness: As indicated on Drawings.
  - b. Length: Maximum available in place.
  - c. Ends: Square cut.
  - d. Edges: Square.
10. Gypsum Shaftliner:
- a. Comply with ASTM C1396/C1396M.



- b. Thickness: 1”.
  - c. Size: Maximum available in place.
  - d. Ends: Square cut.
  - e. Edges: Square.
  - f. Mold resistant.
11. Gypsum Coreboard:
- a. Comply with ASTM C1396/C1396M.
  - b. Thickness: As indicated on Drawings.
  - c. Size: Maximum available in place.
  - d. Ends: Square cut.
  - e. Edges: Square.
12. Predecorated Gypsum Board:
- a. Thickness: As indicated on Drawings.
  - b. Length: Maximum permissible.
  - c. Ends: Square cut.
  - d. Edges: Beveled.
  - e. Snap-on Corner Joints: Manufacturer's standard type with matching vinyl finish
- C. Backer Boards:
1. Fiber-Mat-Reinforced Cement:
- a. Comply with ASTM C1325.
  - b. Description: High-density, glass-fiber reinforced.
  - c. Thickness: As indicated on Drawings.
  - d. Ends: Square cut.
  - e. Edges: Tapered.
  - f. Mold resistant.

## 2.3 ACCESSORIES

- A. Acoustic Insulation:
- 1. Description: Preformed glass fiber; friction-fit type; unfaced.
  - 2. Comply with ASTM C665.
  - 3. Thickness: Full cavity depth.
- B. Acoustic Sealant:
- 1. Description: Non-hardening and non-skinning; for use in conjunction with gypsum board.
- C. Gypsum Board Trim Accessories: Provide types for embedment in joint compound.
- 1. Metal: Galvanized steel.
  - 2. Plastic: PVC.
  - 3. Edge Trim: Type LC bead.
  - 4. Corner Trim:
    - a. Bead: Standard 90°.
    - b. Furnish flexible type for archways and special shapes.
- D. Joint Materials:
- 1. Description: Reinforcing tape, joint compound, and water.
  - 2. Comply with ASTM C475/C475M.

3. Furnish alkali-resistant tape for cementitious backer board joints.
- E. Anchorage to Substrate: Type and size to suit application.
- F. Seismic Bracing: As required to achieve seismic performance requirements.
- G. Adhesive: Comply with ASTM C557.
- H. Textured Finish Materials: Latex-based texturing material, containing fine aggregate.
- I. Gypsum Board Screws:
  1. Comply with ASTM C954.
  2. Length: To suit application.
  3. Steel Framing: Type S.
  4. Wood Framing: Type W.
- J. Gypsum Board Nails:
  1. Description: Blued steel wire; deformed shank.
  2. Comply with ASTM C514.
  3. Length: To suit application.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 01 73 00 "Execution:" Requirements for installation examination.
- B. Verify that Site conditions are ready to receive Work of this Section.
- C. Verify that opening dimensions are as indicated on Shop Drawings.

### 3.2 DEMOLITION

- A. Extend existing gypsum board installations using materials and methods as specified.
- B. Repair and remodel existing gypsum board assemblies that remain or are to be altered.

### 3.3 INSTALLATION

- A. Metal Studs:
  1. Comply with ASTM C754.
  2. Metal Stud Spacing: As indicated on Drawings.
  3. Partitions Extending Stud Framing to Ceiling Only:
    - a. Attach ceiling runner securely according to details indicated on Drawings.
  4. Partitions Extending Stud Framing through Ceiling to Structure:
    - a. As indicated on Drawings.
    - b. Maintain clearance under structural building members to avoid transferring deflection to studs.
    - c. Provide extended-leg ceiling runners.
  5. Opening Framing:
    - a. Install double studs at door and window frame jambs.
    - b. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.

6. Blocking:
  - a. Nail wood blocking to studs.
  - b. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, and hardware.
  
- B. Wall Furring:
  1. Erect wall furring for direct attachment to concrete masonry and concrete walls.
  2. Channels:
    - a. Erect furring channels vertically spaced a maximum of 16" o.c. and not more than 4" from floor and ceiling lines.
    - b. Secure furring in place on alternate channel flanges at maximum 24" o.c.
  3. Erect metal stud framing tight to walls, and attached by adjustable furring brackets.
  
- C. Furring for Fire Ratings: Install furring as required for indicated fire-resistance ratings and comply with GA-600.
  
- D. Shaft Wall Framing: Comply with GA-600.
  
- E. Ceiling Framing:
  1. Comply with ASTM C754.
  2. Coordinate location of hangers with other Work.
  3. Install ceiling framing independent of walls and columns, and above ceiling Work.
  4. Bracing:
    - a. Reinforce openings in ceiling suspension system that interrupt main carrying channels or furring channels, with lateral channel bracing.
    - b. Extend bracing minimum 24" past each end of openings.
    - c. Laterally brace entire suspension system as required for seismic design category.
  
- F. Acoustic Accessories Installation:
  1. Install resilient channels at maximum 24" o.c.
  2. Locate joints over framing members.
  3. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
  4. Install acoustic sealant within partitions.
  
- G. Gypsum Board Installation:
  1. Comply with ASTM C840.
  2. Erect single layer board in most economical direction, with ends and edges located over firm bearing.
  3. Erect single-layer fire-rated gypsum board vertically with edges and ends located over firm bearing.
  4. Fasteners:
    - a. Use screws when fastening gypsum board to metal furring or framing.
  5. Double-Layer Applications:
    - a. Comply with requirements of fire rating.
    - b. First Layer:
      - 1) Use same gypsum board as face layer for first layer, placed perpendicular to framing or furring members.

- 2) Use fire-rated gypsum board for first layer of fire-rated partitions and ceilings.
  - c. Second Layer:
    - 1) Secure second layer to first with fasteners.
    - 2) Place second layer perpendicular to first layer.
    - 3) Offset joints of second layer from joints of first layer.
  6. Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.
  7. Treat cut edges and holes in moisture-resistant gypsum board and exterior gypsum soffit board with sealant.
  8. Control Joints:
    - a. Place control joints consistent with lines of building spaces as indicated on Drawings.
    - b. Place control joints at changes in framing direction and at changes in substrate materials, and align with building control joints.
    - c. Comply with requirements of fire rating and acoustical rating.
  9. Edges and Corners:
    - a. Place corner beads at external and internal corners.
    - b. Place edge trim where gypsum board abuts dissimilar materials.
  10. Cementitious Backing Board over Substrates:
    - a. Wall and Ceiling Framing: Attach to framing with screws spaced at 8" o.c. for walls and 6" o.c. for ceilings.
    - b. Fit boards closely but do not force together.
  11. Floor Slab or Sheathing:
    - a. Adhesively secure to solid floor.
    - b. Stagger joints between boards and between boards and joints in substrate.
    - c. Fit boards closely but do not force together.
    - d. Leave 1/4" joint between floor and wall.
  12. Apply gypsum board to curved walls according to GA-216.
- H. Joint Treatment:
1. Finish:
    - a. Comply with GA-214, Level 4.
    - b. Level 1 finish may be used on concealed above finished ceilings surfaces.
  2. Feather coats on adjoining surfaces such that maximum camber is 1/32".
  3. Fill and finish joints and corners of cementitious backing board.
- I. Pre-decorated Gypsum Board Finish:
1. Erect pre-decorated gypsum board vertically.
  2. Install panels and exposed trim fastening system according to manufacturer instructions.

### 3.4 TOLERANCES

- A. Section 01 40 00 "Quality Requirements:" Requirements for tolerances.
- B. Maximum Variation of Finished Gypsum Board Surface from Flat Surface:  $\frac{1}{8}$ " in 10'-0".

3.5 PROTECTION

- A. Section 01 70 00 "Closeout Procedures:" Requirements for protecting finished Work.
- B. Protect pre-decorated gypsum board installations from damage and deterioration until date of Substantial Completion.

END OF SECTION 09 21 16

04 December 2019

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PSA 8193

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SECTION 09 30 00

TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Ceramic and porcelain mosaic tile for floor and wall applications.
  - 2. Cementitious backer board as tile substrate.
  - 3. Thresholds at door openings.
  - 4. Accessories.
  
- B. Related Requirements:
  - 1. Section 07 90 00 "Joint Protection:" Sealing of joints between tile and other Work.

1.2 REFERENCE STANDARDS

- A. American National Standards Institute:
  - 1. ANSI A108.1A - Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.
  - 2. ANSI A108.1B - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar.
  - 3. ANSI A108.1C - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar.
  - 4. ANSI A108.4 - Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive.
  - 5. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
  - 6. ANSI A108.6 - Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy.
  - 7. ANSI A108.7 - Specifications for Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar.
  - 8. ANSI A108.8 - Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout.
  - 9. ANSI A108.9 - Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
  - 10. ANSI A108.10 - Installation of Grout in Tilework.
  - 11. ANSI A118.1 - Standard Specifications for Dry-Set Cement Mortar.
  - 12. ANSI A118.3 - Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive.
  - 13. ANSI A118.4 - Standard Specifications for Modified Dry-Set Cement Mortar.
  - 14. ANSI A118.5 - Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation.
  - 15. ANSI A118.6 - Standard Specifications for Standard Cement Grouts for Tile Installation.
  - 16. ANSI A118.8 - Standard Specifications for Modified Epoxy Emulsion Mortar/Grout.

17. ANSI A118.9 - Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
  18. ANSI A136.1 - Standard Specifications for Organic Adhesives for Installation of Ceramic Tile.
  19. ANSI A137.1 - Standard Specifications for Ceramic Tile.
- B. ASTM International:
1. ASTM C847 - Standard Specification for Metal Lath.
  2. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.
- C. California Department of Health Services:
1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.
- D. Scientific Certification Systems:
1. SCS EC10.2 - Environmental Certification Program: Indoor Air Quality Performance.
- E. South Coast Air Quality Management District:
1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.
- F. The Tile Council of North America:
1. TCNA - Handbook for Ceramic, Glass, and Stone Tile Installation.
- 1.3 PREINSTALLATION MEETINGS
- A. Section 01 30 00 "Administrative Requirements:" Requirements for pre-installation meeting.
- B. Convene minimum one week prior to commencing Work of this Section.
- 1.4 SUBMITTALS
- A. Section 01 33 00 "Submittal Procedures:" Requirements for submittals.
- B. Product Data: Submit manufacturer information regarding tile, grout, and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, accessories, and setting details.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer Instructions: Submit instructions for using grouts and adhesives.
- F. Qualifications Statements:
1. Submit qualifications for manufacturer and installer.
  2. Submit manufacturer's approval of installer.
- 1.5 SUSTAINABLE DESIGN SUBMITTALS
- A. Section 01 81 13 "Sustainable Design Requirements:" Requirements for sustainable design submittals.
- B. Manufacturer's Certificate:
1. Certify that products meet or exceed specified sustainable design requirements.
  2. Materials Resources Certificates:



- a. Certify source and origin for salvaged and reused products.
  - b. Certify recycled material content for recycled content products.
  - c. Certify source for regional materials and distance from Project Site.
3. Indoor Air Quality Certificates:
- a. Certify VOC content for each interior adhesive and sealant and related primer.
  - b. Certify VOC content for each flooring system.
  - c. Certify VOC content for each ceiling and wall system.
- C. Product Cost Data:
- 1. Submit cost of products to verify compliance with Project sustainable design requirements.
  - 2. Exclude cost of labor and equipment to install products.
  - 3. Provide cost data for following products:
    - a. Salvaged, refurbished, and reused products.
    - b. Products with recycled material content.
    - c. Regional products.
- 1.6 CLOSEOUT SUBMITTALS
- A. Section 01 77 00 “Closeout Procedures:” Requirements for submittals.
  - B. Operation and Maintenance Data: Submit recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.
- 1.7 MAINTENANCE MATERIAL SUBMITTALS
- A. Section 01 73 00 “Execution:” Requirements for maintenance materials.
  - B. Extra Stock Materials: Furnish 10 sq. ft. of each size, color, and surface finish of tile specified.
- 1.8 QUALITY ASSURANCE
- A. Perform Work according to applicable standards.
  - B. Maintain one copy of each standard affecting Work of this Section on Site.
- 1.9 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
  - B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.
- 1.10 DELIVERY, STORAGE, AND HANDLING
- A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.
  - B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
  - C. Store materials according to manufacturer instructions.
  - D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Protect adhesives and grouts from freezing or overheating.
3. Provide additional protection according to manufacturer instructions.

#### 1.11 AMBIENT CONDITIONS

- A. Section 01 50 00 "Temporary Facilities and Controls:" Requirements for ambient condition control facilities for product storage and installation.
- B. Do not install adhesives and grouts in unventilated environment.
- C. Maintain ambient and substrate temperature of 50°F during installation of mortar materials.

#### 1.12 WARRANTY

- A. Section 01 77 00 "Closeout Procedures:" Requirements for warranties.
- B. Furnish five year manufacturer's warranty for tile.

### PART 2 - PRODUCTS

#### 2.1 TILE

- A. Manufacturers:
  1. Crossville.
  2. Substitutions: As specified in Section 01 60 00 "Product Requirements."
- B. Ceramic Tile:
  1. Moisture Absorption: 0.0% to 0.5%.
  2. Size: Reference drawings.
  3. Shape: Reference drawings.
  4. Edge: Square.
  5. Surface Finish: Matte glazed>.
  6. Color: As selected.
- C. Porcelain Floor Tile:
  1. Moisture Absorption: 0.0% to 0.5%.
  2. Size: Reference drawings.
  3. Shape: Square.
  4. Edge: Square.
  5. Surface Finish: Slip Resistant.
  6. Color: As selected.
  7. Pattern: Reference drawings.

#### 2.2 MATERIALS

- A. Adhesives:
  - a. Comply with ANSI A118.3.
  - b. Type: Thin-set bond.
  - c. Tile-Setting Adhesive: Elastomeric, waterproof, liquid applied.

- B. Mortar:
  - 1. Mortar Bed Materials:
    - a. Comply with ANSI A108.1A.
    - b. Components: Portland cement, sand, water, proportioned according to applicable code.
  - 2. Mortar Bond Coat Materials:
    - a. Dry-Set Portland Cement: Comply with ANSI A118.1.
    - b. Latex-Portland Cement: Comply with ANSI A118.4.
    - c. Epoxy: Comply with ANSI A118.3.
    - d. Furan: Comply with ANSI A118.5.
- C. Grout:
  - 1. Standard Grout:
    - a. All types according to ANSI A118.6.
    - b. Color Admixture: Site mixed; as manufactured by Bostik or approved equal.
    - c. Color: As selected.
- D. Cleavage Membrane: No. 15 asphalt-saturated felt.
- E. Waterproofing Membrane at Floors: Chlorinated-Polyethylene-Sheet: Non-plasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030" nominal thickness; as manufactured by The Noble Company or approved equal.

## 2.3 ACCESSORIES

- A. Thresholds:
  - 1. Material: Marble.
  - 2. Color: As selected.
  - 3. Finish: Honed.
  - 4. Size: Full width of wall or frame opening.
  - 5. Bevel: Both sides.
  - 6. Edges: Radiused from bevel to vertical face.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 01 77 00 "Closeout Procedures:" Requirements for installation examination.
- B. Verify that surfaces are ready to receive Work of this Section.

### 3.2 PREPARATION

- A. Section 01 73 00 "Execution:" Requirements for installation preparation.
- B. Protect adjacent Work from damage.
- C. Vacuum clean surfaces and damp clean.
- D. Seal substrate surface cracks with filler.
- E. Level existing substrate surfaces to acceptable flatness tolerances.
- F. Cementitious Backer Board:
  - 1. Tape joints and corners.

2. Cover with skim coat of dry-set mortar to feather edge.

G. Prepare substrate surfaces for adhesive installation.

H. Existing Work:

1. Prepare and remodel existing tile installations using materials and methods as specified in this Section.
2. Clean and repair existing tile that remains.

### 3.3 INSTALLATION

A. Install tile and thresholds, and grout according to ANSI A108.1A and TCNA Handbook recommendations.

B. Pattern:

1. Lay tile to indicated pattern.
2. Do not interrupt tile pattern through openings.

C. Thresholds: Place at indicated locations.

D. Alignment:

1. Cut and fit tile to penetrations through tile, leaving sealant joint space.
2. Form corners and bases neatly.
3. Align floor, wall, and base joints.

E. Joints:

1. Place tile with joints uniform in width, subject to variance in tolerance allowed in tile size.
2. Make joints watertight, without voids, cracks, or excess mortar or grout.
3. Width:
  - a. Wall Tile: 1/16".
  - b. Floor Tile: 1/8".
4. Expansion and Control Joints:
  - a. Keep free of adhesive or grout.
  - b. Apply sealant to joints according to TCNA Handbook Method EJ171.

F. Angles:

1. Internal: Coved.
2. External: Bullnosed.

G. Install ceramic accessories rigidly in prepared openings.

H. Sounding:

1. Sound tile after setting.
2. Replace hollow sounding units.

I. Allow tile to set for a minimum of 48 hours prior to grouting.

J. Grouting:

1. Grout tile joints.
2. Use standard grout unless otherwise indicated.

K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

- L. Thin-Set Methods for Floors:
  - 1. Over Interior Concrete Substrates:
    - a. According to TCNA Handbook Method F113, dry-set or latex-portland cement bond coat, using standard grout, unless otherwise indicated.
    - b. Where waterproofing membrane is indicated, install according to TCNA Handbook Method F122, with latex-portland cement grout.
  
- M. Mortar Bed Methods for Floors:
  - 1. Over Interior Concrete Substrates:
    - a. Comply with TCNA Handbook Method F111, with cleavage membrane.
    - b. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install according to TCNA Handbook Method F121.
  - 2. Cleavage Membrane: Lap edges and ends, and seal watertight.
  - 3. Mortar Bed Thickness:  $\frac{5}{8}$ ", unless otherwise indicated.
  
- N. Wall Tile:
  - 1. Over Cementitious Backer Units:
    - a. Comply with TCNA Handbook Method W244, using membrane at restrooms.

### 3.4 CLEANING

- A. Section 01 77 00 "Closeout Procedures:" Requirements for cleaning.
- B. Clean tile and grout surfaces.

### 3.5 PROTECTION

- A. Section 01 77 00 "Closeout Procedures:" Requirements for protecting finished Work.
- B. Do not permit traffic over finished floor surface for four days after installation.

END OF SECTION 09 30 00

04 December 2019

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Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 09 51 23

ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Acoustic units.
  - 2. Perimeter trim.
- B. Related Requirements:
  - 1. Section 07 90 00 "Joint Protection:" Acoustic sealant for perimeter moldings.

1.2 REFERENCE STANDARDS

- A. ASTM International:
  - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
  - 3. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.
- B. California Department of Public Health:
  - 1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.
- C. Ceilings & Interior Systems Construction Association:
  - 1. CISCA - Acoustical Ceilings Use & Practice.
- D. Intertek Testing Services (Warnock Hersey Listed):
  - 1. WH - Certification Listings.
- E. NFPA:
  - 1. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
- F. South Coast Air Quality Management District:
  - 1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.
- G. UL:
  - 1. UL - Fire Resistance Directory.

1.3 PREINSTALLATION MEETINGS

- A. Section 01 30 00 "Administrative Requirements:" Requirements for pre-installation meeting.
- B. Convene minimum one week prior to commencing Work of this Section.

## 1.4 SEQUENCING

- A. Section 01 10 00 “Summary:” Requirements for sequencing.
- B. Sequence Work of this Section to ensure that acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead Work has been completed, tested, and approved.
- C. Install acoustic units after interior wet Work has dried.

## 1.5 SUBMITTALS

- A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
- B. Product Data: Submit manufacturer information regarding acoustic units.
- C. Shop Drawings: Indicate tile layout and related junctions with other Work or ceiling finishes, interrelation of mechanical and electrical items related to system.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer Instructions: Submit special procedures, perimeter conditions requiring special attention.

## 1.6 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 “Sustainable Design Requirements:” Requirements for sustainable design submittals.
- B. Manufacturer's Certificate:
  - 1. Certify that products meet or exceed specified sustainable design requirements.
  - 2. Materials Resources Certificates:
    - a. Certify source and origin for salvaged and reused products.
    - b. Certify recycled material content for recycled content products.
    - c. Certify source for regional materials and distance from Project Site.
  - 3. Indoor Air Quality Certificates:
    - a. Certify VOC content for each interior adhesive, sealant, and related primer.
    - b. Certify VOC content for each ceiling and wall system.
- C. Product Cost Data:
  - 1. Submit cost of products to verify compliance with Project sustainable design requirements.
  - 2. Exclude cost of labor and equipment to install products.
  - 3. Provide cost data for following products:
    - a. Salvaged, refurbished, and reused products.
    - b. Products with recycled material content.
    - c. Regional products.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 01 73 00 “Execution:” Requirements for maintenance materials.
- B. Extra Stock Materials:
  - 1. Furnish 10 percent of total acoustic unit area of extra tiles to Owner.

## 1.8 QUALITY ASSURANCE



- A. Comply with CISCA requirements.
- B. Fire-Rated Construction:
  - 1. Rating: As indicated on Drawings.
  - 2. Testing: Comply with ASTM E119.
- C. Surface-Burning Characteristics:
  - 1. Testing: Comply with NFPA 286.
  - 2. During 40-kW Exposure: No flame spread to ceiling.
  - 3. During 160-kW Exposure: No flame spread to perimeter of tested sample and no flashover.
  - 4. Total Smoke Release: Maximum 1,000 cu. m.
- D. Perform Work according to applicable standards.
- E. Maintain one copy of each standard affecting Work of this Section on Site.

#### 1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 "Product Requirements:" Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Provide additional protection according to manufacturer instructions.

#### 1.11 AMBIENT CONDITIONS

- A. Section 01 50 00 "Temporary Facilities and Controls:" Requirements for ambient condition control facilities for product storage and installation.
- B. Maintain uniform temperature of minimum 60°F and maximum relative humidity of 40% prior to, during, and after installation.

### PART 2 - PRODUCTS

#### 2.1 ACOUSTICAL CEILINGS

- A. Manufacturers:
  - 1. Armstrong Industries
  - 2. US Gypsum
  - 3. BPB America Inc.

4. Substitutions: As specified in Section 01 60 00 "Product Requirements."
- B. Acoustic Tile (ACT-1):
1. "Optima Tegular"
  2. Comply with ASTM E1264.
  3. Size: 24"x24".
  4. Thickness: 5/8".
  5. Composition: Mineral.
  6. Light Reflectance: 88%.
  7. Noise Reduction Coefficient Range: 95
  8. Sound Transmission Class Range: 25
  9. Joint: Kerfed.
  10. Edge: Square.
  11. Surface Color: White.
  12. Surface Finish:
    - a. Non-directional fissured.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Section 01 77 00 "Closeout Procedures:" Requirements for installation examination.
- B. Verify that substrate conditions are ready to receive Work of this Section.

#### 3.2 INSTALLATION

- A. Kerf tile edges at intersection of ceiling and vertical surfaces.
- B. Center tile on room axis leaving equal border units.
- C. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
- D. Lay directional patterned units one way with pattern parallel to longest room axis. Fit border units neatly against abutting surfaces.
- E. Install acoustic units level in uniform plane.

#### 3.3 TOLERANCES

- A. Section 01 40 00 "Quality Requirements:" Requirements for tolerances.
- B. Maximum Variation from Flat and Level Surface: 1/8" in 10'-0".

END OF SECTION 09 51 23

SECTION 09 54 23

LINEAR METAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Suspended metal grid ceiling system and perimeter trim.
- B. Related Requirements:
  - 1. Section 09 21 16 "Gypsum Board Assemblies:" Suspension system as substrate for this section.

1.2 REFERENCE STANDARDS

- A. ASTM International:
  - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
  - 3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 4. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - 5. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  - 6. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
  - 7. ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
  - 8. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - 9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 10. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - 11. ASTM E580/E580M - Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
- B. American Society of Civil Engineers:
  - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. California Department of Health Services:
  - 1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

- D. Ceilings and Interior Systems Construction Association:
  - 1. CISCA - Acoustical Ceilings: Use and Practice.
- E. Green Seal:
  - 1. GC-03-2nd Edition, January 7, 1997 - Anti-Corrosive Paints.

### 1.3 COORDINATION

- A. Section 01 30 00 "Administrative Requirements:" Requirements for coordination.
- B. Coordinate Work of this section with installation of mechanical and electrical components and with other construction activities affected by Work of this section.
- C. Supply hanger clips during steel deck erection. Supply additional hangers and inserts as required.

### 1.4 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 "Administrative Requirements:" Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

### 1.5 SUBMITTALS

- A. Section 01 33 00 "Submittal Procedures:" Requirements for submittals.
- B. Product Data: Submit data for component profiles, materials, perimeter and integral trim, and space closures. Performance characteristics.
- C. Shop Drawings:
  - 1. Indicate ceiling and soffit system reflected plan, location of mechanical and electrical components, details of junction with dissimilar materials, and points of suspension.
  - 2. Indicate installation details required for seismic design loads.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### 1.6 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 "Sustainable Design Requirements:" Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
  - 1. Materials Resources Certificates:
    - a. Certify source and origin for salvaged and reused products.
    - b. Certify recycled material content for recycled content products.
    - c. Certify source for regional materials and distance from Project site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify volatile organic compound content for each interior paint and coating.
    - b. Certify volatile organic compound content for each ceiling and wall system.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for the following products:
    - a. Salvaged, refurbished, and reused products.

- b. Products with recycled material content.
- c. Regional products.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 01 73 00 “Execution:” Requirements for maintenance materials.
- B. Extra Stock Materials:
  - 1. Furnish ten standard lengths linear ceiling panels.

1.8 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc.
- B. Maintain one copy of each document on site.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 “Product Requirements:” Requirements for transporting, handling, storing, and protecting products.
- B. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.
- C. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

1.11 WARRANTY

- A. Section 01 77 00 “Closeout Procedures:” Requirements for warranties.
- B. Furnish five year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

PART 2 - PRODUCTS

2.1 LINEAR METAL CEILING SYSTEM

- A. Manufacturers:
  - 1. Armstrong Industries
  - 2. US Gypsum
  - 3. BPB America Inc.
  - 4. Substitutions: Section 01 60 00 “Product Requirements.”
- B. Performance / Design Criteria:
  - 1. Installed Ceiling and Soffit and Suspension System:

- a. Support dead loads, including light fixtures and accessories, without eccentric loading of supports.
  - b. Resist dead loads with maximum deflection of 1/720 of span.
2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated according to ASCE 7 and applicable codes.

## 2.2 COMPONENTS

- A. Linear Panels: Steel sheet, ASTM A653/A653M, 0.024" thick, galvanized with G90 zinc coating.
  1. Profile: Channel shape, 1" x 3" forming 4" module.
  2. Edge: Square.
  3. Length: Equal.
  4. Sight-Exposed Surface Finish: from manufacturer's standard range.
- B. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels.
- C. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.
- D. Accessories: Stabilizer bars, clips, and hold down clips, as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.
- E. Suspension Wire: Steel, annealed, galvanized finish, 9-gauge diameter.
- F. Subgirt Members: ASTM A653/A653M, galvanized with G90 zinc coating, formed to resist imposed loads and to provide attachment for linear panels and accessories.
- G. Access Panel: Furnish matching hinged panel [with frameless appearance], swinging downward, with spring latch; 2'-0" x 2'-0" in size.
- H. Air Distribution Devices: Fully integrated with ceiling system, requiring no interruption of suspension components, adjustable from below ceiling, relocatable, and independently suspended.
- I. Light Fixtures: Fabricated to fit system, requiring no interruption of suspension components, and independently suspended.
- J. Touch-up Paint For Concealed Items: Zinc oxide type.

## 2.3 FABRICATION

- A. Shop cut linear panels to accommodate mechanical and electrical items.
- B. Form internal and external corners of same material, thickness, finish, and profile to match exposed linear panels; back brace internal corners.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 01 77 00 "Closeout Procedures:" Requirements for installation examination.
- B. Verify layout of hangers do not interfere with other work.
- C. Verify required utilities are available, in proper location, and ready for use.
- D. Verify field measurements are as indicated on shop drawings.

### 3.2 INSTALLATION

- A. Suspension Components:
1. Install after above ceiling / soffit work is complete in accordance with ASTM C635, ASTM C636 and as supplemented in this section.
  2. Install suspension system in accordance with ASTM E580/E580M and CISCA for Seismic Zone 0-2.
  3. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
  4. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span required distance.
  5. Locate suspension system for linear panel layout as indicated on Drawings.
- B. Linear Panels: Stagger end joints minimum 12".
1. Butt interior end joints tight.
  2. Install edge moldings at intersections of ceiling or soffit junctions with other finishes, and at vertical surfaces; use maximum piece lengths.
  3. Where bullnosed masonry units occur, install radiused closures to fit edge molding.
  4. Install end caps at sight-exposed ends of linear panels.
  5. Field miter corners.
  6. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.

### 3.3 TOLERANCES

- A. Section 01 40 00 "Quality Requirements:" Tolerances.
- B. Maximum Variation from Flat and Level Surface:  $\frac{1}{8}$ " in 10'-0".
- C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2°.
- D. Maximum Variation From Dimensioned Position:  $\frac{1}{4}$ ".

### 3.4 CLEANING

- A. Section 01 77 00 "Closeout Procedures:" Requirements for cleaning.
- B. Remove protective coating or film.
- C. Clean polished surfaces.
- D. Replace damaged or abraded components.

END OF SECTION 09 54 23

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 09 68 13

TILE CARPETING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Carpet tile, fully adhered.
  - 2. Accessories.
- B. Related Requirements:
  - 1. Section 09 65 13 "Resilient Flooring:" Base finish.

1.2 REFERENCE STANDARDS

- A. ASTM International:
  - 1. ASTM D2859 - Standard Specification for Ignition Characteristics of Finished Textile Floor Covering Materials.
- B. California Department of Health Services:
  - 1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.
- C. Carpet and Rug Institute:
  - 1. CRI Carpet Installation Standard - Standard for Installation of Commercial Carpet.
  - 2. CRI Green Label Plus Testing Program.
  - 3. CRI Model Specifications for Commercial Carpets.
- D. Consumer Products Safety Commission:
  - 1. CPSC 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs.
- E. National Fire Protection Association:
  - 1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

1.3 SUBMITTALS

- A. Section 01 33 00 "Submittal Procedures".
- B. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples:
  - 1. Submit two carpet tiles illustrating color and pattern design for each carpet color selected. Matching roll carpet samples.
- D. Manufacturer's Instructions: Submit special procedures and perimeter conditions requiring special attention.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Section 01 30 00 “Submittal Procedures.”
- B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 01 33 00 “Submittal Procedures.”
- B. Extra Stock Materials:
  - 1. Furnish 5% of carpet tiles of each color and pattern selected.

#### 1.6 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
  - 1. Floor Finishes: Comply with one of the following:
    - a. Class I, minimum 0.45 watts/sq cm when tested in accordance with NFPA 253.
    - b. CPSC 16 CFR 1630.

#### 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years experience.
- B. Installer: Company specializing in performing work of this section with minimum five years experience and approved by manufacturer.
  - 1. FCIB or IFCI certified carpet installers.

#### 1.8 AMBIENT CONDITIONS

- A. Section 01 32 00 “Temporary Facilities.”
- B. Store materials in area of installation for minimum 48 hours prior to installation.

### PART 2 PRODUCTS

#### 2.1 CARPET TILE

- A. Manufacturers:
  - 1. Basis of Design Product: Miliken
  - 2. Substitutions: Section 01 30 00 “Submittal Procedures.”

#### 2.2 ACCESSORIES

- A. Sub-Floor Filler: latex Type recommended by flooring material manufacturer.
- B. Moldings and Edge Strips: Rubber or Vinyl color as selected by architect.
- C. Contact Adhesive: Recommended by carpet manufacturer releasable type.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Section 01 77 00 "Closeout Procedures."
- B. Verify floor surfaces are smooth and flat within tolerances specified and are ready to receive work.

#### 3.2 PREPARATION

- A. Section 01 77 00 "Closeout Procedures."
- B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Clean substrate.

#### 3.3 INSTALLATION

- A. Install carpet tile in accordance with CRI Carpet Installation Standard.
- B. Do not mix carpet from different cartons unless from same dye lot.
- C. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- D. Install carpet tile in square pattern, with pile direction alternating to next unit, set parallel to building lines.
- E. Locate change of color or pattern between rooms under door centerline.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

#### 3.4 CLEANING

- A. Section 01 77 00 "Closeout Procedures."
- B. Remove excess adhesive from floor, base, and wall surfaces without damage.
- C. Clean and vacuum carpet surfaces.

END OF DOCUMENT 09 68 13

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 09 90 00

PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Surface preparation and field application of paints and other coatings.

1.2 DEFINITIONS

- A. Refer to ASTM D16 for definitions of terms used in this Section.

1.3 REFERENCE STANDARDS

A. ASTM International:

1. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. California Department of Public Health:

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

C. Green Seal:

1. GS-03 - Anti-Corrosive Paints.
2. GS-11 - Paints and Coatings.

D. Master Painters Institute:

1. MPI - Approved Products List.
2. MPI - Architectural Painting Manual.

E. South Coast Air Quality Management District:

1. SCAQMD Rule 1113 - Architectural Coatings.

1.4 PREINSTALLATION MEETINGS

- A. Section 01 30 00 "Administrative Requirements:" Requirements for pre-installation meeting.
- B. Convene minimum one week prior to commencing Work of this Section.

1.5 SEQUENCING

- A. Section 01 10 00 "Summary:" Requirements for sequencing.
- B. Do not apply finish coats until paintable sealant is applied.

## 1.6 SUBMITTALS

- A. Section 01 33 00 “Submittal Procedures:” Requirements for submittals.
- B. Product Data:
  - 1. Submit manufacturer data on finishing products.
  - 2. Include MPI - Approved Products Lists with proposed products highlighted.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit special surface preparation procedures and substrate conditions requiring special attention.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- F. Qualifications Statements:
  - 1. Submit qualifications for manufacturer and applicator.
  - 2. Submit manufacturer's approval of applicator.

## 1.7 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 “Sustainable Design Requirements:” Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify that following products meet or exceed specified sustainable design requirements:
  - 1. Materials Resources Certificates:
    - a. Certify recycled material content for recycled content products.
    - b. Certify source for regional materials and distance from Project Site.
  - 2. Indoor Air Quality Certificates:
    - a. Certify VOC content for each interior paint and coating.
    - b. Certify VOC content for each flooring system.
    - c. Certify VOC content for each ceiling and wall system.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
  - 1. Provide cost data for following products:
    - a. Products with recycled material content.
    - b. Regional products.

## 1.8 CLOSEOUT SUBMITTALS

- A. Section 01 77 00 “Closeout Procedures:” Requirements for submittals.
- B. Operation and Maintenance Data: Submit information on cleaning, touchup, and repair of painted and coated surfaces.

## 1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 01 70 00 “Execution:” Requirements for maintenance materials.
- B. Extra Stock Materials:
  - 1. Furnish 1 gal. of each color, type, and surface texture as provided for Project.
  - 2. Label each container with manufacturer's label, color, type, and texture.
  - 3. Store where directed by Owner.

1.10 QUALITY ASSURANCE

- A. MPI Standards:
  - 1. Comply with indicated MPI standards.
  - 2. Products: Listed in MPI - Approved Products List.
- B. Surface Burning Characteristics:
  - 1. Fire-Retardant Finishes: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.
- C. Maintain one copy of each standard affecting Work of this Section on Site.

1.11 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 "Product Requirements:" Requirements for transporting, handling, storing, and protecting products.
- B. Container Labeling: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Inspection:
  - 1. Accept materials on Site in manufacturer's sealed and labeled containers.
  - 2. Inspect for damage and to verify acceptability.
- D. Store materials in ventilated area and otherwise according to manufacturer instructions.
- E. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Provide additional protection according to manufacturer instructions.

1.13 AMBIENT CONDITIONS

- A. Section 01 50 00 "Temporary Facilities and Controls:" Requirements for ambient condition control facilities for product storage and installation.
- B. Storage Conditions:
  - 1. Minimum Ambient Temperature: 45°F.
  - 2. Maximum Ambient Temperature: 90°F.
- C. Application Conditions:
  - 1. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint manufacturer.

2. Do not apply exterior coatings during rain or snow, when relative humidity is outside humidity ranges, or when moisture content of surfaces exceeds those required by paint manufacturer.
3. Minimum Application Temperatures for Latex Paints: 45°F for interiors and 50°F for exteriors, unless otherwise indicated by manufacturer instructions.

#### 1.14 WARRANTY

- A. Section 01 73 00 "Execution:" Requirements for warranties.
- B. Furnish five-year manufacturer's warranty for paint and coatings.

### PART 2 - PRODUCTS

#### 2.1 PAINTS AND COATINGS

- A. Manufacturers:
  1. Sherwin Williams
  2. Benjamin Moore
  3. Substitutions: As specified in Section 01 60 00 "Product Requirements."
- B. Materials:
  1. Coatings:
    - a. Ready mixed, except field-catalyzed coatings.
    - b. Capable of drying or curing free of streaks or sags.
  2. Patching Materials: Latex filler.
  3. Fastener Head Cover Materials: Latex filler.
  4. Accessories:
    - a. Grade: Commercial.
    - b. Linseed oil.
    - c. Shellac.
    - d. Turpentine.
    - e. Paint thinners.
    - f. Other materials not specifically indicated but required to achieve specified finishes.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Section 01 73 00 "Execution:" Requirements for application examination.
- B. Verify that surfaces are ready to receive Work as recommended by product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of Work, and report conditions capable of affecting proper application to Architect.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Moisture Content:
  1. Measure moisture content of surfaces using electronic moisture meter.



2. Do not apply finishes unless moisture content of surfaces are below following maximums:
  - a. Plaster and Gypsum Wallboard: 12%.
  - b. Masonry, Concrete, and Concrete Unit Masonry: 12%.

### 3.2 PREPARATION

- A. Section 01 73 00 "Execution:" Requirements for application preparation.
- B. Prepare coatings as follows:
  1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
  2. For smooth flow and brushing properties.
- C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Defects:
  1. Correct defects and clean surfaces capable of affecting Work of this Section.
  2. Remove or repair existing coatings exhibiting surface defects.
- E. Marks: Seal marks that may bleed through surface finishes with shellac.
- F. Gypsum Board Surfaces:
  1. Fill minor defects with filler compound.
  2. Spot-prime defects after repair.
- G. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish:
  1. Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter.
  2. Remove oil and grease with solution of tri-sodium phosphate, rinse well, and allow to dry.
  3. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water, and allow to dry.

### 3.3 APPLICATION

- A. Comply with MPI - Architectural Painting Manual.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform appearance.
- D. Apply each coat of paint slightly darker than preceding coat, unless specified otherwise.
- E. Cleaning:
  1. Vacuum surfaces to remove loose particles.
  2. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Fillers:
  1. If clear finishes are required, tint fillers to match wood.
  2. Work fillers into grain before set, and wipe excess from surface.
- G. Finishing Mechanical and Electrical Equipment:
  1. Schedule of Color-Coding and Identification Banding of Equipment, Ductwork, Piping, and Conduit.
  2. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components, and paint separately.

3. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, and collars and supports except where these items are shop finished.
4. Paint interior surfaces of air ducts visible through grilles and louvers with one coat of flat black paint to visible surfaces.
5. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
6. Paint exposed conduit and electrical equipment installed in finished areas.
7. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
8. Color-Coding:
  - a. Color-code equipment, piping, conduit, and exposed duct work according to indicated requirements.
9. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings that were removed prior to finishing.

#### 3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 "Quality Requirements:" Requirements for inspecting and testing.
- B. Inspecting and Testing: Comply with MPI - Architectural Painting Manual.

#### 3.5 CLEANING

- A. Section 01 70 00 "Closeout Procedures:" Requirements for cleaning.
- B. Collect waste material that may constitute fire hazards, place in closed metal containers, and remove daily from Site.

#### 3.6 ATTACHMENTS

- A. Schedule - Interior Surfaces:
  1. Concrete Block:
    - a. One coat of block filler, latex, interior/exterior, MPI #4; B42W46 as manufactured by Sherwin Williams.
    - b. Two coats of latex, interior, eggshell, (MPI Gloss Level 1), MPI #53; Harmony as manufactured by Sherwin Williams.
  2. Gypsum Board and Plaster Walls:
    - a. One coat of latex primer sealer.
    - b. Two coats of latex enamel, eggshell, ProGreen 200 as manufactured by Sherwin Williams.
  3. Metal:
    - a. One coat of Pro-Cryl Universal Water-based Primer, B66-310 as manufactured by Sherwin Williams.
    - b. Two coats of Water-based Industrial Enamel, B53-300 as manufactured by Sherwin Williams.
  4. Previously Painted Surfaces:

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

- a. One coat of Multi-Purpose Interior/Interior Latex Primer Sealer, B51-450 as manufactured by Sherwin Williams.
- b. Two coats of Promar 200 Interior Latex, eggshell, B30W02651 as manufactured by Sherwin Williams.

END OF SECTION 09 90 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 10 26 00

WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes corner guards.
- B. Related Sections:
  - 1. Section 06 10 53 "Miscellaneous Rough Carpentry": Support blocking for wall and corner guard anchors.

1.2 PERFORMANCE REQUIREMENTS

- A. Corner Guards: Resist lateral impact force of 100 lbs at any point without damage or permanent set.

1.3 SUBMITTALS

- A. Section 01 33 00 "Submittal Procedures": Submittal procedures.
- B. Product Data: Submit physical dimensions, features, anchorage details, and rough-in measurements.
- C. Samples: Submit two sections of corner guard 12" long, illustrating component design, configuration, color and finish.
- D. Manufacturer's Installation Instructions: Submit procedures, and perimeter conditions requiring special attention.

1.4 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.
- B. Material must be stored flat.

1.6 COORDINATION

- A. Section 01 31 00 "Project Coordination."
- B. Coordinate Work with wall or partition sections for installation of concealed blocking or anchor devices.

PART 2 PRODUCTS

2.1 CORNER GUARDS

- A. Manufacturers:

1. Basis of Design Product: Construction Specialties (CS Group) Model SM-20 N or approved equal.

B. Substitutions: Section 01 60 00 "Product Requirements."

C. Product Description: Surface mounted guard consisting of a continuous metal retainer with snap-on cover.

## 2.2 MATERIALS

A. Engineered PETG: Extruded material should be high impact Acrovyn 4000 with shadowgrain texture, nominal .078" (1.98mm) thickness. Chemical and stain resistance should be per ASTM D543 standards as established by the manufacturer. Colors to be from one of manufacturer's standard color range.

B. Aluminum: Extruded aluminum retainers should be 6063-T6 alloy, nominal .062" (1.57mm) thickness. Minimum strength and durability properties as specified in ASTM B221.

C. Fasteners: All fasteners to be non-corrosive and compatible with aluminum retainers. All necessary fasteners to be supplied by the manufacturer.

D. Corner Guards

1. Engineered PETG Corner Guards to be Acrovyn 4000 by Construction Specialties: Surface mounted guards consisting of a continuous retainer with snap-on Acrovyn 4000 cover. Color matched end caps to be provided for both partial and full height applications. Attachment hardware shall be appropriate for wall construction.

a. Model SM-20AN, 90° surface mounted corner guard with 3" legs, ¼" radiused cover and aluminum retainer. Color as selected by Architect from one of manufacturer's solid colors

## 2.3 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

C. General: Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish and member sizes.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 31 00 "Project Coordination."

B. Verify rough-in for components are correctly sized and located.

### 3.2 INSTALLATION

A. Position corner guard approximately 5" above finished floor (align with top of floor base) to approximately 65" high, unless otherwise indicated on the drawings.

### 3.3 CLEANING

A. General: Immediately upon completion of installation, clean material in accordance with manufacturer's recommended cleaning method.

- B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

### 3.4 PROTECTION

- A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION 10 26 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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## SECTION 12 24 13

### ROLLER WINDOW SHADES

#### 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. Manually operated roller shades with single rollers.
- B. Related Requirements:
  - 1. Section 06 10 00 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shade materials, orientation to rollers, and seam and batten locations.
- C. Samples: for each exposed product and for each color and texture specified, 10" long.
- D. Section Includes:
  - 1. Manually operated roller shades with single rollers.
- E. Samples for Initial Selection: for each type and color of fabric band material.
  - 1. Include Samples of accessories involving color selection.
- F. Samples for Verification: for each type of roller shade.
  - 1. Shade Material: not less than 6" square. Mark inside face of material if applicable.
  - 2. Roller Shade: Full-size operating unit, not less than 16" wide x 36" long for each type of roller shade indicated.
  - 3. Installation Accessories: Full-size unit, not less than 6" long.
- G. Roller Shade Schedule: Use same designations indicated on drawings.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of fabric band material, signed by product manufacturer.
- C. Product Test Reports: For each type of fabric band material, for tests performed by manufacturer and witnessed by a qualified testing agency or performed by a qualified testing agency.

## 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: for roller shades to include in maintenance manuals.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra material that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Roller Shades: Full-size units equal to 5% of quantity installed for each size, color, and fabric band material indicated, but no fewer than two units.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualification: Fabricator of products.
  - 1. Installer shall be qualified to install specified products by prior experience and approved by manufacturer.
  - 2. Installer shall be responsible for acceptable installation in accordance with instructions published by manufacturer.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on drawings.

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Springs Window Fashions.
- B. Substitutions: Section 01 60 00 "Product Requirements."
- C. Source Limitations: Obtain roller shades from single source from single manufacturer.

### 2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: with continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chain: #10 Stainless Steel.
    - a. Loop Length: as required to operate full height of window shade.
    - b. Limit Stops: provide upper and lower round nickel-plated steel ball stops.
    - c. Chain-Retainer Type: locking style chain retainer restricts the operation of the chain unless the chain retainer is properly mounted to a fixed surface such as a window frame, sill, or wall. Compliant with American National Standard Safety of Corded Window Covering Products ANSI A100.0. Non-locking P-Clip is not acceptable.
      1. Color: Black
  2. Spring Lift-Assist Mechanisms (SA): Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
    - a. Provide 6 lb. lift assist for shades as recommended by manufacturer.
- B. Rollers: Extruded-aluminum tubes engineered with channel to accept fabric spline. The diameter and wall thickness to be determined by manufacturer based on fabric selection and shade size to provide minimal deflection and optimal performance.
1. Clutch System: Consists of fiberglass filled nylon for wear resistance, smooth operation and corrosion resistance. The clutch is comprised Velvetrol™ internal spring arrangement for a smooth pulling force that locks the shade in any position when operating the control loop. The clutch mechanism is bi-directional and does not require adjustment or lubrication. Clutch to be inserted in roller tube at manufacturing. Clutch size to be selected by manufacturer based on fabric selection and shade size. Clutch size and spring assist upgrade available SL30 W.
  2. Roller Drive-End Location: Right side of shade.
  3. Direction of Shade Roll: Regular, from back of roller, unless otherwise noted, reverse from front of roller.
  4. Fabric-to-Roller Attachment: removable spline system shall consist of a co-extruded PVC spline heat-welded to the shade fabric and inserted into an engineered channel on the roller tube. The spline system allows for adjustability on site and ease n changing fabric bands in the field.
  5. Idler End: Constructed of high strength, fiberglass filled nylon with spring-loaded pin-end technology for wear resistance, smooth operation, and corrosion resistance.
  6. Dual-Roller Mounting Configuration: Offset, outside roller over and inside roller under
- C. Mounting Hardware: brackets, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
1. Thickness; 16 gauge.
  2. Material: Stamped steel.
  3. Description: fascia bracket, black powder coated.
- D. Roller-Coupling Assemblies: Coordinate with operating mechanism and designed to couple up to three inline rollers into a linked shade system that is operable by one roller drive-end assembly. Linking system allows alignment of hem bars without removing shade from brackets by the Infinite Adjuster.
- E. Fabric Bands:
1. Fabric Band Material: Light-filtering fabric.
  2. Fabric Band Bottom (Hem) Bar: Extruded aluminum.
    - a. Type: Hem bars to be extruded aluminum in weight sufficient for proper shade operation. Enclosed in heat sealed pocket of fabric brand material.

- b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attached to roller brackets without exposed fasteners.
  - a. Shape: L-Shaped
  - b. Height: Manufacturer's standard height required to conceal roller and shade when shade is fully open, but not less than 3.75".
  - c. Color and Finish: Clear satin anodized
2. Fascia End Caps: Flat steel plate, adhered to fascia bracket using double-sided tape.
  - a. Shape: 3.75" x 3.125"
  - b. Color and Finish: Black powder coated

## 2.3 FABRIC BAND MATERIALS

- A. Fabric Band Material Flame-Resistant Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

## 2.4 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with ANSI-WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measure at 74°F:
1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Fabric Band Fabrication: Fabricate fabric bands without battens or seams to extent possible except as follows:
1. Railroad Materials: Railroad material where material roll width is less than the required width of fabric band and where indicated. Provide battens and seams as required by railroad material to produce fabric bands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of fabric band.
- D. Crosshatch Light-Filtering Fabric: Woven fabric, stain and fade resistant.
1. Source: Springs Window Fashions.
  2. Type: Woven polyester and PVC-coated polyester.
  3. Weave: Basketweave.
  4. Roll Width: 98".
  5. Orientation of Fabric Band: Vertical.
  6. Openness Factor:
    - a. A300 - (3% openness)
  7. Color: As selected by Architect from manufacturer's full range.

## PART 3 EXECUTION

### 3.1 EXAMINATION

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

### 3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

### 3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

### 3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, ensuring that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 12 24 13

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Stack-sleeve fittings.
  - 3. Sleeve-seal systems.
  - 4. Sleeve-seal fittings.
  - 5. Grout.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Smith, Jay R. Mfg. Co.
  - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
  - 3. Josam Company
  - 4. Or approved equal.
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with setscrews.

## 2.3 SLEEVE-SEAL SYSTEMS

- 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. Advance Products & Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company (The).
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Or approved equal.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Presealed Systems.
  - 2. Thunder Link Seal.
  - 3. The Metraflex Company
  - 4. Or approved equal.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

## 2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1" annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.



- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2" above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide ¼" annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 00 "Firestopping."

### 3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
  - 1. Install fittings that are large enough to provide ¼" annular clear space between sleeve and pipe or pipe insulation.
  - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 Section "Sheet Metal Flashing and Trim."
  - 3. Install section of cast-iron soil pipe to extend sleeve to 2" above finished floor level.
  - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 00 "Firestopping."

### 3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.4 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.

### 3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
    - b. Piping NPS 6 and Larger: Cast-iron wall sleeves.
  - 2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1" annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1" annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Interior Partitions:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 22 05 17

SECTION 22 05 18

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
- C. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

END OF SECTION 22 05 18

## SECTION 22 05 23

### GENERAL-DUTY VALVES FOR PLUMBING PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  1. Bronze ball valves.
  2. Bronze lift check valves.
  3. Bronze swing check valves.
  4. Bronze gate valves.
  5. Bronze globe valves.
  6. Lubricated plug valves.

##### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. NRS: Nonrising stem.
- C. OS&Y: Outside screw and yoke.
- D. RS: Rising stem.
- E. SWP: Steam working pressure.

##### 1.4 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  2. ASME B31.1 for power piping valves.
  3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

##### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  1. Protect internal parts against rust and corrosion.
  2. Protect threads, flange faces, grooves, and weld ends.
  3. Set angle, gate, and globe valves closed to prevent rattling.
  4. Set ball and plug valves open to minimize exposure of functional surfaces.
  5. Block check valves in either closed or open position.

- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Handwheel: For valves other than quarter-turn types.
  - 2. Handlever: For quarter-turn valves NPS 6 and smaller.
  - 3. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
- E. Valves in Insulated Piping: With 2" stem extensions and the following features:
  - 1. Gate Valves: With rising stem.
  - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  - 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Grooved: With grooves according to AWWA C606.
  - 3. Solder Joint: With sockets according to ASME B16.18.
  - 4. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

### 2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
  - 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. American Valve, Inc.
    - b. Conbraco Industries, Inc.; Apollo Valves.
    - c. Crane Co.; Crane Valve Group; Crane Valves.
    - d. Hammond Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO INC.
    - g. Red-White Valve Corporation.
    - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - i. Or approved equal.

2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded or soldered.
  - g. Seats: PTFE or TFE.
  - h. Stem: Bronze.
  - i. Ball: Chrome-plated brass.
  - j. Port: Full.

### 2.3 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
  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. American Valve, Inc.
    - b. Crane Co.; Crane Valve Group; Crane Valves.
    - c. Crane Co.; Crane Valve Group; Jenkins Valves.
    - d. Crane Co.; Crane Valve Group; Stockham Division.
    - e. Hammond Valve.
    - f. Milwaukee Valve Company.
    - g. NIBCO INC.
    - h. Red-White Valve Corporation.
    - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - j. Or approved equal.
  2. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: Bronze.

### 2.4 BRONZE GATE VALVES

- A. Class 125, RS Bronze Gate Valves:
  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. American Valve, Inc.
    - b. Crane Co.; Crane Valve Group; Crane Valves.
    - c. Crane Co.; Crane Valve Group; Jenkins Valves.
    - d. Crane Co.; Crane Valve Group; Stockham Division.
    - e. Hammond Valve.
    - f. Kitz Corporation.
    - g. Milwaukee Valve Company.

- h. NIBCO INC.
  - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - j. Or approved equal.
2. Description:
- a. Standard: MSS SP-80, Type 2.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
  - d. Ends: Threaded or solder joint.
  - e. Stem: Bronze.
  - f. Disc: Solid wedge; bronze.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable bronze.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

#### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Lift Check Valves: With stem upright and plumb.

#### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

#### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball or gate valves.



2. Pump-Discharge Check Valves:
  - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
  4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  6. For Steel Piping, NPS 5 and Larger: Flanged ends.
  7. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

### 3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
  1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
  2. Ball Valves: Two piece, full port, bronze with bronze trim.
  3. Bronze Swing Check Valves: Class 125, bronze disc.
  4. Bronze Gate Valves: Class 125, RS.
  5. Bronze Globe Valves: Class 125, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
  1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

END OF SECTION 22 05 23

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Thermal-hanger shield inserts.
  - 4. Fastener systems.
  - 5. Pipe stands.
  - 6. Pipe positioning systems.
  - 7. Equipment supports.
- B. Related Sections:
  - 1. Division 21 fire-suppression piping Sections for pipe hangers for fire-suppression piping.
  - 2. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
  - 3. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment.

## 1.5 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

### 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

### 2.3 THERMAL-HANGER SHIELD INSERTS

- 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. Carpenter & Paterson, Inc.
  - 2. Clement Support Services.
  - 3. ERICO International Corporation.
  - 4. National Pipe Hanger Corporation.
  - 5. PHS Industries, Inc.
  - 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
  - 7. Piping Technology & Products, Inc.
  - 8. Rilco Manufacturing Co., Inc.
  - 9. Or approved equal.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2" beyond sheet metal shield for piping operating below ambient air temperature.

## 2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.5 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
  - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  - 2. Base: Plastic.
  - 3. Vertical Members: Two or more cadmium-plated-steel, continuous-thread rods.
  - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

## 2.6 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## 2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

## 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4" thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
- F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Section 22 44 00 "Plumbing Fixtures" for requirements for pipe positioning systems for plumbing fixtures.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

- a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180°.
  - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

### 3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.

- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

END OF SECTION 22 05 29



SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Stencils.
  - 5. Valve tags.
  - 6. Warning tags.

1.3 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,  $\frac{1}{8}$ " 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 160°F.
  - 5. Minimum Label Size: Length and width vary for required label content, but not less than  $2\frac{1}{2}$ " x  $\frac{3}{4}$ ".
  - 6. Minimum Letter Size:  $\frac{1}{4}$ " for name of units if viewing distance is less than 24",  $\frac{1}{2}$ " for viewing distances up to 72", and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 7. Fasteners: Stainless-steel self-tapping screws.
  - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8½" x 11" bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus 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, ⅛" thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160°F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2½" x ¾".
- F. Minimum Letter Size: ¼" for name of units if viewing distance is less than 24", ½" for viewing distances up to 72", and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel 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 1½" high.

## 2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with ¼" letters for piping system abbreviation and ½" numbers.
  - 1. Tag Material: Brass, 0.032" minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass S-hook.
- B. Valve Schedules: For each piping system, on 8½" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space),

normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
  1. Size: Approximately 4" x 7".
  2. Fasteners: Brass grommet and wire.
  3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  4. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 PREPARATION

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

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50'-0" along each run. Reduce intervals to 10'-0" in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
  1. Medium-Pressure, Compressed-Air Piping:
    - a. Background Color: White.
    - b. Letter Color: Black.

2. Domestic Water Piping:
  - a. Background Color: White.
  - b. Letter Color: Blue.
3. Sanitary Waste and Storm Drainage Piping:
  - a. Background Color: White.
  - b. Letter Color: Black.

### 3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; 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.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  1. Valve-Tag Size and Shape:
    - a. Cold Water: 1½", round.
    - b. Hot Water: 1½", round.
    - c. High-Pressure Compressed Air: 1½", round.
    - d. Gas: 1-1/2 inches, round.
    - e. Vacuum: 1½", round.
  2. Valve-Tag Color:
    - a. Cold Water: Natural.
    - b. Hot Water: Natural.
    - c. High-Pressure Compressed Air: Natural.
    - d. Gas: Natural.
    - e. Vacuum: Natural.
  3. Letter Color:
    - a. Cold Water: White.
    - b. Hot Water: Black.
    - c. High-Pressure Compressed Air: Black.
    - d. Gas: Black.
    - e. Vacuum: Black.

### 3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 07 19

PLUMBING PIPING 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 insulating the following plumbing piping services:
  - 1. Domestic cold-water piping.
  - 2. Domestic hot-water piping.
  - 3. Domestic recirculating hot-water piping.
  - 4. Roof drains and rainwater leaders.
  - 5. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
  - 1. Division 22 Section "Plumbing Equipment."

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for

installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.6 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 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 Fiberglass Corporation.
    - b. Certainteed Corp.
    - c. Johns Manville
    - d. Armstrong
    - e. Or approved equal.
  - 2. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2, 1" thick.

### 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of -100°F to 200°F.
  - 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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Use adhesive that complies 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.
- C. PVC Jacket Adhesive: Compatible with PVC jacket.

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; 739, Dow Silicone.
  - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
  - c. P.I.C. Plastics, Inc.; Welding Adhesive.
  - d. Or approved equal.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies 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.

### 2.3 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

### 2.4 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers,:
  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. Engineered Brass Company.
    - b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
    - c. McGuire Manufacturing.
    - d. Truebro; a brand of IPS Corporation.
    - e. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
    - f. Or approved equal.
  2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.

### 3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.



6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

### 3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
- C. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
  2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.8 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. NPS ½ and Larger: Insulation shall be the following:
    - a. Cellular Glass: 1” thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS ½ and Larger: Insulation shall be the following:
    - a. Cellular Glass: 1” thick.
- C. Stormwater:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Cellular Glass: 1” thick.
- D. Roof Drain and Overflow Drain Bodies:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Cellular Glass: 1” thick.

END OF SECTION 22 07 19

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
  - 2. Encasement for piping.
  - 3. Specialty valves.
  - 4. Flexible connectors.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components.
- C. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
  - 2. Do not proceed with interruption of water service without Owner's written permission.

1.6 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## PART 2 - PRODUCTS

## 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

## 2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
  2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
  4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
  5. Copper Pressure-Seal-Joint Fittings:
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Elkhart Products Corporation; Industrial Division.
      - 2) NIBCO INC.
      - 3) Viega; Plumbing and Heating Systems.
      - 4) Or approved equal.
    - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
    - c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
  6. Copper-Tube Extruded-Tee Connections:
    - 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) T-DRILL Industries Inc.
      - 2) Pro-Press.
      - 3) Nibco, Inc.
      - 4) Or approved equal.
    - b. Description: Tee formed in copper tube according to ASTM F 2104.
  7. Grooved-Joint Copper-Tube Appurtenances:
    - 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) Anvil International.
      - 2) Shurjoint Piping Products.
      - 3) Victaulic Company.
      - 4) Or approved equal.

- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
  - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  - 2. Copper Pressure-Seal-Joint Fittings:
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Elkhart Products Corporation; Industrial Division.
      - 2) NIBCO INC.
      - 3) Viega; Plumbing and Heating Systems.
      - 4) Or approved equal.

### 2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 1. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.
  - 2. Compact-Pattern, Mechanical-Joint Fittings: AWWA C153, ductile iron.
    - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
    - a. Gaskets: AWWA C111, rubber.
  - 2. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.
    - a. Gaskets: AWWA C111, rubber.

### 2.4 SPECIALTY VALVES

- A. Comply with requirements in Section 22 05 23 "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Section 22 11 16 "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

### 2.5 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Flex-Hose Co., Inc.
  - 2. Flexicraft Industries.
  - 3. Flex Pression, Ltd.
  - 4. Flex-Weld, Inc.
  - 5. Hyspan Precision Products, Inc.
  - 6. Mercer Rubber Co.
  - 7. Metraflex, Inc.
  - 8. Or approved equal.

- B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
  - 1. Working-Pressure Rating: Minimum 200 psig.
  - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
  - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
  
- C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
  - 1. Working-Pressure Rating: Minimum 200 psig.
  - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
  - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

### PART 3 - EXECUTION

#### 3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

#### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Section 22 11 16 "Domestic Water Piping Specialties" for drain valves and strainers.
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Section 22 11 16 "Domestic Water Piping Specialties" for pressure-reducing valves.
- H. Install domestic water piping level and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. 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.

- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping adjacent to equipment and specialties to allow service and maintenance.
- O. Install piping to permit valve servicing.
- P. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- Q. Install piping free of sags and bends.
- R. Install fittings for changes in direction and branch connections.
- S. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- T. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- U. Install aquastats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
- V. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

- I. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.
- J. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Section 22 05 23 "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use gate valves for piping NPS 2-1/2 and larger.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Section 22 11 16 "Domestic Water Piping Specialties."
  - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
  - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller. Comply with requirements in Section 22 11 16 "Domestic Water Piping Specialties" for balancing valves.
- E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Section 22 11 16 "Domestic Water Piping Specialties" for calibrated balancing valves.

### 3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

### 3.6 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.

### 3.7 WATER METER INSTALLATION

- A. Rough-in domestic water piping for water meter installation and install water meters according to utility company's requirements.
- B. Water meters will be furnished and installed by Plumbing Contractor.
- C. Install water meters according to utility company's requirements.



### 3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. MSS Type 1, adjustable, steel clevis hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60" with 3/8" rod.
  - 2. NPS 1 and NPS 1-1/4: 72" with 3/8" rod.
  - 3. NPS 1-1/2 and NPS 2: 96" inches with 3/8" rod.
  - 4. NPS 2-1/2: 108" with 1/2" rod.
  - 5. NPS 3 to NPS 5: 10'-0" with 1/2" rod.
  - 6. NPS 6: 10'-0" with 5/8" rod.

### 3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
  - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
  - 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.10 IDENTIFICATION

- A. Identify system components. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

### 3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
  - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

- D. Domestic water piping will be considered defective if it does not pass tests and inspections.  
E. Prepare test and inspection reports.

### 3.12 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
  2. Open shutoff valves to fully open position.
  3. Open throttling valves to proper setting.
  4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.

6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.13 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
  1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.14 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

### 3.15 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
  2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
  3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
  4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

END OF SECTION 22 11 16

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.
  - 3. Encasement for underground metal piping.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10'-0" head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
  - 1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
  - 2. Laboratory Test Reports for Credit EQ 4: For solvent cements and adhesive primers, documentation indicating that products 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."
- C. Shop Drawings: For solvent drainage system. Include plans, elevations, sections, and details.
- D. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
  - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ANACO-Husky.
    - b. Dallas Specialty & Mfg. Co.
    - c. Fernco Inc.
    - d. Matco-Norca, Inc.
    - e. MIFAB, Inc.
    - f. Mission Rubber Company; a division of MCP Industries, Inc.
    - g. Tyler Pipe.
    - h. Charlotte.
    - i. Or approved equal.
  - 2. Standards: ASTM C 1277 and CISPI 310.

3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. ANACO-Husky.
  - b. Clamp-All Corp.
  - c. Dallas Specialty & Mfg. Co.
  - d. MIFAB, Inc.
  - e. Mission Rubber Company; a division of MCP Industries, Inc.
  - f. Tyler Pipe.
  - g. Charlotte.
  - h. Or approved equal.
2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:

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. MG Piping Products Company.
  - b. Clamp All.
  - c. Huskey
  - d. Or approved equal.
2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Copper Pressure Fittings:
  1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- D. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
  1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8" maximum thickness unless thickness or specific material is indicated.
  2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

- E. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## PART 3 - EXECUTION

### 3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep  $\frac{1}{4}$  bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and  $\frac{1}{8}$ -bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than  $90^\circ$ . Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Drain: 2% downward in direction of flow for piping NPS 3 and smaller; 1% downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2% downward in direction of flow.
  - 3. Vent Piping: 1% down toward vertical fixture vent or toward vent stack.



- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- O. Install steel piping according to applicable plumbing code.
- P. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.
- Q. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- R. Install engineered soil and waste drainage and vent piping systems as follows:
  - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- S. Plumbing Specialties:
  - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
- T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.
- F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

- G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  4. Vertical Piping: MSS Type 8 or Type 42, clamps.
  5. Install individual, straight, horizontal piping runs:
    - a. 100'-0" and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100'-0": MSS Type 43, adjustable roller hangers.
  6. Multiple, Straight, Horizontal Piping Runs 100'-0" or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  7. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12" of each fitting, valve, and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60" with 3/8" rod.
  2. NPS 3: 60" with 1/2" rod.
  3. NPS 4 and NPS 5: 60" with 5/8" rod.
  4. NPS 6 and NPS 8: 60"s with 3/4" rod.
  5. NPS 10 and NPS 12: 60" inches with 7/8" rod.
  6. Spacing for 10'-0" lengths may be increased to 10'-0". Spacing for fittings is limited to 60".
- G. Install supports for vertical cast-iron soil piping every 15'-0".
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72" with 3/8" rod.
  2. NPS 1-1/2 and NPS 2: 96" with 3/8" rod.
  3. NPS 2-1/2: 108" with 1/2" rod.
  4. NPS 3 and NPS 5: 10'-0" with 1/2" rod.
  5. NPS 6: 10'-0" with 5/8" rod.
  6. NPS 8: 10'-0" with 3/4" rod.
- I. Install supports for vertical copper tubing every 10'-0".
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  - 5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
  - 6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

### 3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10'-0" head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1" wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

### 3.8 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

### 3.9 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
  1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
  3. Copper DWV tube, copper drainage fittings, and soldered joints.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
  1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
  1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
  3. Copper DWV tube, copper drainage fittings, and soldered joints.

- a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
  
- E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
  - 1. Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.
  - 2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; and coupled joints.
  
- F. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
  - 1. Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.
  - 2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; coupled joints.

END OF SECTION 22 13 16

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:
  - 1. Fixture supports.
  - 2. Kitchen sinks.
  - 3. Owner-furnished fixtures.

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - 2. Stainless-Steel Commercial, Sinks: NSF 2 construction.
  - 3. Vitreous-China Fixtures: ASME A112.19.2M.
  - 4. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
  - 1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  - 2. Hose-Connection Vacuum Breakers: ASSE 1011.
- I. Comply with the following applicable standards and other requirements specified for shower faucets:
  - 1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
  - 2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
  - 3. Hand-Held Showers: ASSE 1014.
  - 4. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
  - 5. Manual-Control Antiscald Faucets: ASTM F 444.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
  - 1. Atmospheric Vacuum Breakers: ASSE 1001.
  - 2. Manual-Operation Flushometers: ASSE 1037.
  - 3. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Off-Floor Fixture Supports: ASME A112.6.1M.
  - 2. Plastic Toilet Seats: ANSI Z124.5.
  - 3. Supply and Drain Protective Shielding Guards: ICC A117.1.

## PART 2 - EXECUTION

### 2.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

### 2.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.



- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install counter-mounting fixtures in and attached to casework.
- E. Install fixtures level and plumb according to roughing-in drawings.
- F. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Section 22 05 23 "General-Duty Valves for Plumbing Piping."
- G. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- H. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- I. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- J. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- K. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- L. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- M. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- N. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant.

### 2.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

### 2.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

## 2.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.

## 2.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

## 2.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40°C and at altitude of 3300'-0" above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.

- D. Multispeed Motors: Variable torque.
  1. For motors with 2:1 speed ratio, consequent pole, single winding.
  2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
  1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

#### 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers:
  1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

#### 2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  1. Permanent-split capacitor.
  2. Split phase.
  3. Capacitor start, inductor run.
  4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

END OF SECTION 23 05 13

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Metal pipe hangers and supports.
  2. Trapeze pipe hangers.
  3. Metal framing systems.
  4. Thermal-hanger shield inserts.
  5. Fastener systems.
  6. Pipe stands.
  7. Equipment supports.

1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  3. See Section 23 05 48 for seismic-restraint hangers and supports for piping and equipment.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

## 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.3 THERMAL-HANGER SHIELD INSERTS

- 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. Carpenter & Paterson, Inc.
  - 2. Clement Support Services.
  - 3. National Pipe Hanger Corporation.
  - 4. Piping Technology & Products, Inc.
  - 5. Or approved equal.
- B. Insulation-Insert Material for Cold Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2" beyond sheet metal shield for piping operating below ambient air temperature.

## 2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated stainless- steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.5 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
  - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  - 2. Base: Plastic.
  - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
  - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

- E. High-Type, Multiple-Pipe Stand:
  - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
  - 2. Bases: One or more; plastic.
  - 3. Vertical Members: Two or more protective-coated-steel channels.
  - 4. Horizontal Member: Protective-coated-steel channel.
  - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## 2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4" thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.
- I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.



4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2: 12" long and 0.048" thick.
  - b. NPS 4: 12" long and 0.06" thick.
  - c. NPS 5 and NPS 6: 18" long and 0.06" thick.
  - d. NPS 8 to NPS 14: 24" long and 0.075" thick.
  - e. NPS 16 to NPS 24: 24" long and 0.105" thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1½".

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050°F, pipes NPS 4 to NPS 24, requiring up to 4" of insulation.
  3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4" of insulation.
  4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6" for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120°F to 450°F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120°F to 450°F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1/4".
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated a load and limit variability factor to 25% to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25% to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25% to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.
    - b. Variable-air-volume systems.
    - c. Multizone systems.
  - 2. Balancing Hydronic Piping Systems:
    - a. Constant-flow hydronic systems.
    - b. Variable-flow hydronic systems.
    - c. Primary-secondary hydronic systems.
  - 3. Verification of performance of all equipment and automatic temperature controls.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

- A. LEED Submittal:
  - 1. Air-Balance Report for LEED Prerequisite EQ 1: Documentation of work performed for ASHRAE 62.1-2013, Section 7.2.2, "Air Balancing."
- B. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- C. Certified TAB reports.
- D. Sample report forms.
- E. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.

4. Dates of use.
5. Dates of calibration.

## 1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
  1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
  2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.
- B. TAB Conference: Meet with the Contractor and Commissioning Contractor on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
  1. Agenda Items:
    - a. The Contract Documents examination report.
    - b. The TAB plan.
    - c. Coordination and cooperation of trades and subcontractors.
    - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
  1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

## 1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## 1.7 COORDINATION

- A. Notice: Provide fourteen (14) days' advance notice for each test to Contractor, Commissioning Contractor, Architect and Engineer. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.
- C. TAB Contractor shall participate with Commissioning Contractor in verification of up to 25% of readings. Failure of 10% will require an additional 25% of readings to be verified. Failure or an additional 10% will require total re-balance of affected system.



## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

## 3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, available TAB contractors that may be engaged include, but are not limited to, the following:
1. USC Environmental
  2. Eastern Air Balance Co., Inc.
  3. National Air Balance Co., Inc.
  4. Technical Airflow, Inc.
  5. Or approved equal.

## 3.2 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 23 31 13 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.
- Q. Review automatic temperature control sequences with and coordinate measurement and calibration of automatic temperature control devices with automatic temperature controls installer.

### 3.3 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Hydronic systems are filled, clean, and free of air.
  - 3. Automatic temperature-control systems are operational.
  - 4. Equipment and duct access doors are securely closed.
  - 5. Balance, smoke, and fire dampers are open.
  - 6. Isolating and balancing valves are open and control valves are operational.
  - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
  - 1. Comply with requirements in ASHRAE 62.1-2013, Section 7.2.2 "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with removable plugs or test ports.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 30 "Air Duct Accessories."
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 00 "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

### 3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  - 2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Report the cleanliness status of filters and the time static pressures are measured.
  - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
  - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  - 6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
  3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### 3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
  2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
  3. Measure total system airflow. Adjust to within indicated airflow.
  4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to

- make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
    - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
  6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
    - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
  7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
  8. Record final fan-performance data.

### 3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5%.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
  1. Open all manual valves for maximum flow.
  2. Check liquid level in expansion tank.
  3. Check makeup water-station pressure gage for adequate pressure for highest vent.
  4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
  5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
  6. Set system controls so automatic valves are wide open to heat exchangers.
  7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
  8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

### 3.9 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
  1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
    - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Engineer and comply with requirements in Division 23 Section "Hydronic Pumps."

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
    - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
  3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  4. Report flow rates that are not within plus or minus 10% of design.
- B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
- C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- D. Set calibrated balancing valves, if installed, at calculated presettings.
- E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
  1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5% greater than indicated flow.
- G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
  1. Determine the balancing station with the highest percentage over indicated flow.
  2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  3. Record settings and mark balancing devices.
- H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- J. Check settings and operation of each safety valve. Record settings.

### 3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

### 3.11 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  1. Manufacturer's name, model number, and serial number.
  2. Motor horsepower rating.
  3. Motor rpm.
  4. Efficiency rating.
  5. Nameplate and measured voltage, each phase.
  6. Nameplate and measured amperage, each phase.

7. Starter thermal-protection-element rating.

- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

### 3.12 PROCEDURES FOR BOILERS

- A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

### 3.13 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

- B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

- C. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

### 3.14 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans:  $\pm 5\%$ .
2. Air Outlets and Inlets:  $\pm 5\%$ .
3. Heating-Water Flow Rate:  $\pm 5\%$ .
4. Cooling-Water Flow Rate:  $\pm 5\%$ .

## 3.15 REPORTING

- A. Draft Reports: Upon completion of testing, adjusting and balancing procedures, prepare draft reports on the approved forms. Draft reports may be handwritten, but must be complete, factual, accurate and legible. Organize and format draft reports in the same manner specified for the final reports. Submit two (2) complete sets of draft reports. Only one (1) complete set of draft reports will be returned.

## 3.16 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
  2. Fan curves.
  3. Manufacturers' test data.
  4. Field test reports prepared by system and equipment installers.
  5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
  2. Name and address of the TAB contractor.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.
  10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  14. Notes to explain why certain final data in the body of reports vary from indicated values.
  15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.



- e. Fan drive settings including settings and percentage of maximum pitch diameter.
  - f. Inlet vane settings for variable-air-volume systems.
  - g. Settings for supply-air, static-pressure controller.
  - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Water flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Terminal units.
  6. Balancing stations.
  7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.
    - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - j. Number, make, and size of belts.
    - k. Number, type, and size of filters.
  2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  3. Test Data (Indicated and Actual Values):
    - a. Total air flow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Filter static-pressure differential in inches wg.
    - f. Preheat-coil static-pressure differential in inches wg.
    - g. Cooling-coil static-pressure differential in inches wg.
    - h. Heating-coil static-pressure differential in inches wg.
    - i. Outdoor airflow in cfm.
    - j. Return airflow in cfm.
    - k. Outdoor-air damper position.
    - l. Return-air damper position.

- m. Vortex damper position.
- F. Apparatus-Coil Test Reports:
- 1. Coil Data:
    - a. System identification.
    - b. Location.
    - c. Coil type.
    - d. Number of rows.
    - e. Fin spacing in **fins per inch** o.c.
    - f. Make and model number.
    - g. Face area in **sq. ft.**
    - h. Tube size in **NPS**.
    - i. Tube and fin materials.
    - j. Circuiting arrangement.
  - 2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in **cfm**.
    - b. Average face velocity in **fpm**.
    - c. Air pressure drop in **inches wg**.
    - d. Outdoor-air, wet- and dry-bulb temperatures in **deg F**.
    - e. Return-air, wet- and dry-bulb temperatures in **deg F**.
    - f. Entering-air, wet- and dry-bulb temperatures in **deg F**.
    - g. Leaving-air, wet- and dry-bulb temperatures in **deg F**.
    - h. Water flow rate in **gpm**.
    - i. Water pressure differential in **feet of head or psig**.
    - j. Entering-water temperature in **deg F**.
    - k. Leaving-water temperature in **deg F**.
    - l. Refrigerant expansion valve and refrigerant types.
    - m. Refrigerant suction pressure in **psig**.
    - n. Refrigerant suction temperature in **deg F**.
- G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
- 1. Unit Data:
    - a. System identification.
    - b. Location.
    - c. Coil identification.
    - d. Capacity in **Btu/h**.
    - e. Number of stages.
    - f. Connected volts, phase, and hertz.
    - g. Rated amperage.
    - h. Air flow rate in **cfm**.
    - i. Face area in **sq. ft.**
    - j. Minimum face velocity in **fpm**.
  - 2. Test Data (Indicated and Actual Values):
    - a. Heat output in **Btu/h**.
    - b. Air flow rate in **cfm**.
    - c. Air velocity in **fpm**.
    - d. Entering-air temperature in **deg F**.

- e. Leaving-air temperature in **deg F**.
  - f. Voltage at each connection.
  - g. Amperage for each phase.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in **inches**, and bore.
    - h. Center-to-center dimensions of sheave, and amount of adjustments in **inches**.
  - 2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in **inches**, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in **inches**.
    - g. Number, make, and size of belts.
  - 3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in **cfm**.
    - b. Total system static pressure in **inches wg**.
    - c. Fan rpm.
    - d. Discharge static pressure in **inches wg**.
    - e. Suction static pressure in **inches wg**.
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
- 1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in **deg F**.
    - d. Duct static pressure in **inches wg**.
    - e. Duct size in **inches**.
    - f. Duct area in **sq. ft**.
    - g. Indicated air flow rate in **cfm**.
    - h. Indicated velocity in **fpm**.
    - i. Actual air flow rate in **cfm**.
    - j. Actual average velocity in **fpm**.
    - k. Barometric pressure in **psig**.
- J. Air-Terminal-Device Reports:
- 1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.

- c. Apparatus used for test.
  - d. Area served.
  - e. Make.
  - f. Number from system diagram.
  - g. Type and model number.
  - h. Size.
  - i. Effective area in **sq. ft.**.
2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in **cfm.**
    - b. Air velocity in **fpm.**
    - c. Preliminary air flow rate as needed in **cfm.**
    - d. Preliminary velocity as needed in **fpm.**
    - e. Final air flow rate in **cfm.**
    - f. Final velocity in **fpm.**
    - g. Space temperature in **deg F.**
- K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
    - a. System and air-handling-unit identification.
    - b. Location and zone.
    - c. Room or riser served.
    - d. Coil make and size.
    - e. Flowmeter type.
  2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in **cfm.**
    - b. Entering-water temperature in **deg F.**
    - c. Leaving-water temperature in **deg F.**
    - d. Water pressure drop in **feet of head or psig.**
    - e. Entering-air temperature in **deg F.**
    - f. Leaving-air temperature in **deg F.**
- L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Service.
    - d. Make and size.
    - e. Model number and serial number.
    - f. Water flow rate in **gpm.**
    - g. Water pressure differential in **feet of head or psig.**
    - h. Required net positive suction head in **feet of head or psig.**
    - i. Pump rpm.
    - j. Impeller diameter in **inches.**
    - k. Motor make and frame size.
    - l. Motor horsepower and rpm.
    - m. Voltage at each connection.
    - n. Amperage for each phase.

- o. Full-load amperage and service factor.
  - p. Seal type.
2. Test Data (Indicated and Actual Values):
- a. Static head in **feet of head or psig**.
  - b. Pump shutoff pressure in **feet of head or psig**.
  - c. Actual impeller size in **inches**.
  - d. Full-open flow rate in **gpm**.
  - e. Full-open pressure in **feet of head or psig**.
  - f. Final discharge pressure in **feet of head or psig**.
  - g. Final suction pressure in **feet of head or psig**.
  - h. Final total pressure in **feet of head or psig**.
  - i. Final water flow rate in **gpm**.
  - j. Voltage at each connection.
  - k. Amperage for each phase.

M. Instrument Calibration Reports:

- 1. Report Data:
  - a. Instrument type and make.
  - b. Serial number.
  - c. Application.
  - d. Dates of use.
  - e. Dates of calibration.

3.17 CERTIFICATE OF OCCUPANCY REQUIREMENTS

- A. In addition to the above, the testing and balancing contractor shall comply with the requirements of the Uniform Construction Code, certificate of occupancy requirements, NJAC 5:23-2.23,i7, submission of test and balancing report. The test and balance report for mechanically ventilated Class I and II buildings of use Group B and E shall be prepared and submitted in a timely manner, and shall be included with the written application for a certificate of occupancy that will be filed with the enforcing agency by the Owner. The test and balance report must be submitted by the test and balance professional, certified by the NEBB or AABC. The signed report shall include:
- 1. Minimum quantity of outdoor air required by code.
  - 2. Minimum quantity of outdoor air specified in the design.
  - 3. Actual measured outdoor cubic feet per minute (CFM) or a derived quantity, if actual measurements are not possible.
  - 4. Actual measured CFM.

END OF SECTION 23 05 93

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 23 07 00

HVAC 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 HVAC insulation for piping, ductwork, and equipment.

1.3 DESCRIPTION OF WORK

- A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Types of mechanical insulation specified in this section include the following:
  - 1. Piping Systems Insulation:
    - a. Fiberglass.
    - b. Cellular Glass.
  - 2. Ductwork System Insulation:
    - a. Fiberglass.
    - b. Cellular Glass.
  - 3. Equipment Insulation:
    - a. Fiberglass.
    - b. Cellular Glass.
- C. Refer to Section 23 31 13 "Metal Ducts" for duct linings; not work of this section.
- D. Refer to Section 22 07 19 "Plumbing Piping Insulation" for insulation of plumbing piping, equipment, and accessories; not work of this section.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar services for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
- C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
- D. Insulation Materials: Insulation materials must be manufactured at facilities certified and registered with an approved registrar to conform to ISO 9000 quality standard.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
  - 1. Owens-Corning Fiberglass Corp.
  - 2. Certainteed Corp.
  - 3. Johns-Manville
  - 4. Armstrong
  - 5. Or approved equal.

### 2.2 PIPING INSULATION MATERIALS

- A. Fiberglass Piping Insulation: ASTM C 547, Class 1 unless otherwise indicated.
- B. Cellular Glass Piping Insulation: ASTM C 552, Type II, Class 2.
- C. Jackets for Piping Insulation: ASTM C 1136, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.
  - 1. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
  - 2. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
  - 3. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

### 2.3 EXPOSED OUTDOOR DUCTWORK INSULATION MATERIALS

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form.
- B. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. In addition, the product when tested shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire tests.
- C. Materials shall have a maximum thermal conductivity of 0.27 Btu-in/h-ft<sup>2</sup>-°F at a 75°F mean temperature when tested in accordance with ASTM C177 or ASTM C518, latest revisions.
- D. Materials shall have a maximum water vapor transmission of 0.10 perm-inches when tested in accordance with ASTM E96 (Procedure A), latest revision.
- E. The material shall be manufactured under an independent third party supervision testing program covering the properties of fire performance, thermal conductivity and WVT.
- F. Adhesive shall be the Insulation Manufacturer's recommended contact adhesive.
- G. Insulation Finish shall be the Insulation manufacturer's recommended Finish.



- H. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings as specified above.

#### 2.4 INTERIOR DUCTWORK INSULATION MATERIALS

- A. Rigid Fiberglass Ductwork Insulation: ASTM C 612, Class 4.
- B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, Class B-4.
- C. Jackets for Ductwork Insulation: ASTM C 1136, Type I for ductwork with temperatures below ambient; Type II for ductwork with temperatures above ambient.
- D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.
- F. Range Hood Exhaust Ductwork – 3M 15 A fire barrier duct wrap 1½ thick; 2 hour rating.

#### 2.5 EQUIPMENT INSULATION MATERIALS

- A. Rigid Fiberglass Equipment Insulation: ASTM C 612, Class 2.
- B. Flexible Fiberglass Equipment Insulation: ASTM C 553, Type I, Class B-4.
- C. Jacketing Material for Equipment Insulation: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.
- D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

#### 3.2 HVAC PIPING SYSTEM INSULATION

- A. Insulation Omitted: Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan; on heating piping beyond control valve, located within heated space; on unions, flanges, strainers, flexible connections, and expansion joints.
- B. Cold Piping (40°F to ambient):
  - 1. Application Requirements: Insulate the following cold HVAC piping systems:
    - a. HVAC condensate drain piping.
    - b. Refrigerant piping.
    - c. Water make-up piping.
    - d. Chilled water piping.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
  - a. Fiberglass: 1" thick for pipe sizes up to and including 4", 1½" Thick for pipe sizes over 4".
- C. Hot Low Pressure Piping (to 250°F):
  1. Application Requirements: Insulate the following hot low pressure HVAC piping systems.
    - a. HVAC hot water supply and return piping.
  2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
    - a. Fiberglass: 1" thick for pipe sizes up to and including 1¼", 1½" thick for pipe sizes 1½" through 4", 2" thick for pipe sizes 5" and over.
- D. Insulation of Piping Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective aluminum jacketing as recommended by the manufacturer.

### 3.3 DUCTWORK SYSTEM INSULATION

- A. Insulation Omitted: Do not insulate fibrous glass ductwork, or lined ductwork.
- B. Cold Ductwork (Below Ambient Temperature):
  1. Application Requirements: Insulate the following cold ductwork:
    - a. Outdoor air intake ductwork between air entrance and fan inlet of HVAC unit inlet.
    - b. HVAC supply ductwork between fan discharge, or HVAC unit discharge, and room terminal outlet.
    - c. Insulate neck and bells of supply diffusers.
  2. HVAC return ductwork between room terminal inlet and return fan inlet, or HVAC unit inlet; except omit insulation on return ductwork located in return air ceiling plenums.
  3. HVAC plenums and unit housings not pre-insulated at factory or lined.
  4. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:
    - a. Rigid Fiberglass: 1½" thick, increase thickness to 2" in machine, fan and equipment rooms.
    - b. Flexible Fiberglass: 1½" thick, application limited to concealed locations.
- C. Hot Ductwork (Above Ambient Temperature):
  1. Application Requirements: Insulate the following hot ductwork:
    - a. Range and hood exhaust ductwork.
  2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:
    - a. 3-M 15 A fire barrier duct wrap or approved equal: 1½" thick, 2-hour resistant rated.

### 3.4 EQUIPMENT INSULATION

- A. Cold Equipment (Below Ambient Temperature):

1. Application Requirements: Insulate the following cold equipment:
    - a. Drip pans under chilled equipment.
  2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
    - a. Fiberglass: 2" thick for cold surfaces above 35°F (2°C) and 3" thick for surfaces 35°F (2°C) and lower.
    - b. Cellular Glass: 3" thick for surfaces above 35°F (2°C) and 4½" thick for surfaces 35°F (2°C) and lower.
- B. Hot Equipment (Above Ambient Temperature):
1. Application Requirements: Insulate the following hot equipment:
    - a. Air Separators
  2. Insulate each item of equipment specified above with the following type and thickness of insulation.
    - a. Fiberglass: 2" thick

### 3.5 INSTALLATION OF PIPING INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints.
- I. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.
- J. Piping Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective aluminum jacketing as recommended by the manufacturer.

### 3.6 INSTALLATION OF INTERIOR DUCTWORK INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
- F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.
- G. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

### 3.7 INSTALLATION OF EXPOSED OUTDOOR DUCTWORK INSULATION

- A. Square and Rectangular Outdoor Ductwork:
  - 1. 1" thick rubber closed cell sheet insulation shall be adhered directly to clean, oil free surfaces with a full coverage of adhesive.
  - 2. The duct insulation shall be constructed from the bottom up, with a top insulation sized to extend over the side insulation. This will form a water shed.
  - 3. Butt-edge seams shall be adhered using adhesive by the compression fit method to allow for expansion/contraction. Leave a 1/2" wide uncoated border at the butt-edge seams on the duct surface the insulation surface. Overlap the insulation 1/4" at the butt-edges and compress the edges into place. Apply adhesive to the butt-edges of the insulation.
  - 4. Standing metal duct seams shall be insulated with the same insulation thickness as installed on the duct surface. Seams may be covered using strips of tubular pipe insulation with miter-cut ends. Standing seams shall be adhered using manufacturer's recommended adhesive.
  - 5. Seams shall be staggered when applying multiple layers of insulation.
  - 6. Exterior ductwork insulation shall be installed on all ductwork including lined ductwork.
- B. Round Outdoor Ductwork:
  - 1. 1" thick rubber closed cell insulation shall be used on all round ductwork. Insulation shall be wrapped, not stretched, around the duct. On ductwork larger than 12" diameter, the insulation shall be adhered to the duct surface on the lower one third. Longitudinal seams shall be located on the lower half of any round ductwork.
  - 2. Butt-edge seams shall be adhered using adhesive by the compression fit method to allow for expansion/contraction. Leave a 1/2" wide uncoated border at the butt-edge seams on the duct surface the insulation surface. Overlap the insulation 1/4" at the butt-edges and compress the edges into place. Apply adhesive to the butt-edges of the insulation.
  - 3. Seams shall be staggered when applying multiple layers of insulation.
  - 4. Exterior ductwork insulation shall be installed on all exterior ductwork including lined ductwork.
- C. Exposed Outdoor Duct Finish:
  - 1. All outdoor exposed ductwork shall be finished using one of the following applications:
    - a. Rectangular Ductwork:
      - 1) The surface of the insulation must be clean and dry.
      - 2) Allow adhesive seams on the insulation to set for two (2) hours.

- 3) Apply thin uniform coat of spray adhesive. Allow to become tacky and apply 10 x 10 weave glass mesh.
- 4) Allow adhesive and mesh to dry four (4) hours.
- 5) Apply manufacturer's recommended finish over the mesh at a rate of less than 400 square feet per gallon. Allow to dry four (4) hours.
- 6) Apply the second coat of manufacturer's recommended finish at a rate of less than 400 square feet per gallon.

b. Round Ductwork:

- 1) The surface of the insulation must be clean and dry.
- 2) Allow adhesive seams on the insulation to set for two (2) hours.
- 3) Apply thin uniform coat of spray adhesive. Allow to become tacky and apply 10 x 10 weave glass mesh.
- 4) Allow adhesive and mesh to dry four (4) hours.
- 5) Apply manufacturer's recommended finish over mesh at a rate of less than 400 square feet per gallon. Allow to dry four (4) hours.
- 6) Apply the second coat of manufacturer's recommended finish at rate of not more than 400 square feet per gallon.

D. Acceptable Manufacturers:

1. Armstrong
2. Johns Manville
3. Certainteed Corp.
4. Or approved equal.

### 3.8 INSTALLATION OF EQUIPMENT INSULATION

- A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
- C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- D. Do not apply insulation to equipment, breechings, or stacks while hot.
- E. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.
- F. Do not insulate equipment manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- G. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.
- H. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

3.9 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

3.10 INSULATION REPAIR

- A. Repair damaged sections of mechanical insulation, both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation; install new jacket lapping and sealed-over existing.

END OF SECTION 23 07 00

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
  - 2. Suction Lines for Heat-Pump Applications: 535 psig.
  - 3. Hot-Gas and Liquid Lines: 535 psig.

1.3 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.4 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.5 COORDINATION

- A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Refrigerant Valves and Specialties:
    - a. Alco Controls Div, Emerson Electric.
    - b. Henry Valve Company.
    - c. Parker-Hannifin Corporation, Refrigeration and Air Conditioning Division.
    - d. Sporlan Valve Company.
    - e. Or approved equal.

## 2.2 PIPE AND TUBING MATERIALS

- A. General: Refer to paragraph "PIPE APPLICATION" for identification of systems where the below specified pipe and fitting materials are used.
- B. Copper Tubing: ASTM B 280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.

## 2.3 FITTINGS

- A. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.

## 2.4 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).

## 2.5 VALVES

- A. General: Complete valve assembly shall be UL-listed and designed to conform to ARI 760.
- B. Globe: 450 psig maximum operating pressure, 275°F maximum operating temperature; cast bronze body, with cast bronze or forged brass wing cap and bolted bonnet; replaceable resilient seat disc; plated steel stem. Valve shall be capable of being repacked under pressure. Valve shall be straight through or angle pattern, with solder-end connections.
- C. Thermal Expansion Valves: Thermostatic adjustable, modulating type; size as required for specific evaporator requirements, and factory set for proper evaporator superheat requirements. Valves shall have copper fittings for solder end connections; complete with sensing bulb, a distributor having a side connection for hot gas bypass line, and an external equalizer line.
- D. Hot Gas Bypass Valve: Adjustable type, sized to provide capacity reduction beyond the last step of compressor unloading; and wrought copper fittings for solder end connections.

## 2.6 REFRIGERANT PIPING SPECIALTIES

- A. General: Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to ARI 760.
- B. Strainers: 500 psig maximum working pressure; forged brass body with monel 80-mesh screen, and screwed cleanout plug; Y-pattern, with solder end connections.
- C. Moisture/liquid Indicators: 500 psig maximum operation pressure, 200°F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.
- D. Filter-driers: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter-drier core kit, including gaskets, as follows:
  - 1. Standard capacity desiccant sieves to provide micronic filtration.
- E. Suction Line Filter-Drier: 350 psig maximum operation pressure, 225°F maximum operating temperature; steel shell, and wrought copper fittings for solder end connections. Permanent filter element shall be molded felt core surrounded by a desiccant. For removal of acids and moisture for refrigerant vapor.



## 2.7 REFRIGERANT

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Atofina Chemicals, Inc.
  - 2. DuPont Company; Fluorochemicals Div.
  - 3. Honeywell, Inc.; Genetron Refrigerants.
  - 4. INEOS Fluor Americas LLC.
  - 5. Or approved equal.
- C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation.

### 3.2 PIPING APPLICATIONS

- A. Use Type ACR drawn copper tubing with wrought copper fittings and brazed joints above ground, within building.
- B. Use Type K, annealed temper copper tubing for 2" and smaller without joints, below ground and within slabs. Mechanical fittings (crimp or flair) are not permitted.

### 3.3 PIPING INSTALLATIONS

- A. General: Install refrigerant piping in accordance with ASHRAE Standard 15 - "The Safety Code for Mechanical Refrigeration."
- B. Install piping in as short and direct arrangement as possible to minimize pressure drop.
- C. Install piping for minimum number of joints using as few elbows and other fitting as possible.
- D. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.
- E. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.
- F. Insulate all suction lines and cold refrigerant liquid piping with ¾" Armaflex Plenum rated insulation. Provide weather protective coating and UV light protective coating as recommended by the manufacturer for outdoor use.
  - 1. Do not install insulation until system testing has been completed and all leaks have been eliminated.
- G. Install branch tie-in lines to parallel compressors equal length, and pipe identically and symmetrically.
- H. Slope refrigerant piping as follows:

1. Install horizontal hot gas discharge piping with ½” per 10’-0” downward slope away from the compressor.
  2. Install horizontal suction lines with ½” per 10’-0” downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.
  3. Install traps and double risers where indicated, and where required to entrain oil in vertical runs.
  4. Liquid lines may be installed level.
- I. Use fittings for all changes in direction and all branch connections.
  - J. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
  - K. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
  - L. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
  - M. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1” clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
  - N. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
  - O. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6” shall be steel; pipe sleeves 6” and larger shall be sheet metal.
  - P. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 07 for special sealers and materials.
  - Q. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.
  - R. Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.
  - S. Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver.

3.4 HANGERS AND SUPPORTS

- A. General: Hanger, supports, and anchors are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Conform to the table below for maximum spacing of supports:
- C.

D.	NOM PIPE SIZE	E.	MAX SPAN-FT
F.	1	G.	7
H.	1½	I.	9
J.	2	K.	10
L.	3	M.	12
N.	3½	O.	13
P.	4	Q.	14

### 3.5 PIPE JOINT CONSTRUCTION

- A. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
  - 1. **WARNING:** Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.
  - 2. **CAUTION:** When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do not apply heat near the bulb of the expansion valve.
- B. Fill the pipe and fittings during brazing, with an inert gas (i.e., nitrogen or carbon dioxide) to prevent formation of scale.
- C. Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

### 3.6 VALVE INSTALLATIONS

- A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions.
- B. Install globe valves on each side of strainers and driers, in liquid and suction lines at evaporators, and elsewhere as indicated.
- C. Thermostatic expansion valves may be mounted in any position, as close as possible to the evaporator.
  - 1. Where refrigerant distributors are used, mount the distributor directly on the expansion valve outlet.
  - 2. Install the valve in such a location so that the diaphragm case is warmer than the bulb.
  - 3. Secure the bulb to a clean, straight, horizontal section of the suction line using two bulb straps. Do not mount bulb in a trap or at the bottom of the line.
  - 4. Where external equalizer lines are required make the connection where it will clearly reflect the pressure existing in the suction line at the bulb location.

### 3.7 EQUIPMENT CONNECTIONS

- A. The Drawings indicate the general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow servicing and maintenance.

### 3.8 FIELD QUALITY CONTROL

- A. Inspect, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI.
- B. Repair leaking joints using new materials, and retest for leaks.

### 3.9 ADJUSTING AND CLEANING

- A. Verify actual evaporator applications and operating conditions, and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.
- B. Clean and inspect refrigerant piping systems.
- C. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

3.10 COMMISSIONING

- A. Charge system using the following procedure:
  - 1. Install core in filter dryer after leak test but before evacuation.
  - 2. Evacuate refrigerant system with vacuum pump; until temperature of 35°F is indicated on vacuum dehydration indicator.
  - 3. During evacuation, apply heat to pockets, elbows, and low spots in piping.
  - 4. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
  - 5. Break vacuum with refrigerant gas; allow pressure to build up to 2 psi.
  - 6. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.
- B. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance of refrigerant piping valves and refrigerant piping specialties.
- C. Review data in Operating and Maintenance Manuals. Refer to Section 01 77 00 "Closeout Requirements."
- D. Schedule training with Owner through the Architect, with at least 7 days advance notice.

END OF SECTION 23 23 00

## SECTION 23 31 13

### METAL DUCTS

#### PART 1 - GENERAL

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round ducts and fittings.
  - 3. Double-wall round ducts and fittings.
  - 4. Sheet metal materials.
  - 5. Duct liner.
  - 6. Sealants and gaskets.
  - 7. Hangers and supports.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2013.

#### 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data including details of construction relative to materials, dimensions of individual components, profiles, and finishes for the following items:
  - 1. Duct Liner.
  - 2. Sealing Materials.
  - 3. Fire-Stopping Materials.
  - 4. Prefabricated Double Wall Ductwork.
- C. Shop drawings from duct fabrication shop, drawn to a scale not smaller than  $\frac{1}{4}'' = 1'-0''$ , on drawing sheets same size as the Contract Drawings, detailing:
  - 1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.

2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust ducts systems, indicate the classification of the materials handled as defined in this Section.
  3. Fittings.
  4. Reinforcing details and spacing.
  5. Seam and joint construction details.
  6. Penetrations through fire-rated and other partitions.
  7. Terminal unit and coil installations.
  8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
- D. Coordination drawings for ductwork installation. Show the following:
1. Coordination with ceiling suspension members.
  2. Spatial coordination with other systems of all trades installed in the same space with the duct systems.
  3. Coordination of ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
  4. Coordination with ceiling-mounted lighting fixtures and air outlets and inlets.
- E. Welding certificates including welding procedures specifications, welding procedures qualifications test records, and welders' qualifications test records complying with requirements specified in "Quality Assurance" below.
- F. Record drawings including duct systems routing, fittings details, reinforcing, support, and installed accessories and devices.
- G. Maintenance data for volume control devices, fire dampers, and smoke dampers, in accordance with Division 01.
- H. LEED Submittals.
1. Product Data for Prerequisite EQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
  2. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
  3. Leakage Test Report for Prerequisite EA 2: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
  4. Duct-Cleaning Test Report for Prerequisite EQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-Up."
  5. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
  6. Laboratory Test Reports for Credit EQ 4: For adhesives and sealants, documentation indicating that products 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."

## 1.5 QUALITY ASSURANCE

- A. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" for hangers and supports and AWS D9.1 "Sheet Metal Welding Code".
- B. Qualify each welder in accordance with AWS qualification tests for welding processes involved. Certify that their qualification is current.
- C. NFPA Compliance: Comply with the following NFPA Standards: NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.

- D. NFPA 96, "Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors for Commercial Cooking Equipment," Chapter 3, "Duct System," for kitchen hood duct systems, except as indicated otherwise.

## PART 2 - PRODUCTS

### 2.1 SHEET METAL MATERIALS

- A. Sheet Metal, General: Provide sheet metal in thicknesses indicated, packaged and marked as specified in ASTM A 700.
- B. Galvanized Sheet Steel: Lock-forming quality, ASTM A 527, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.
- C. Carbon Steel Sheets: ASTM A 366, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.
- D. Stainless Steel: ASTM A 480, Type 316, sheet form, with No. 4 finish on exposed surface for ducts exposed to view; Type 304, sheet form, with No. 1 finish for concealed ducts.
- E. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish where ducts are exposed to view, and mill finish for concealed ducts.
- F. PVC Coated Round Galvanized Steel: 4 mil coating on interior surfaces and 4 mil coating on exterior surfaces (chemical fume hood exhaust).
- G. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum and stainless steel ducts provide reinforcing of compatible materials.
- H. Tie Rods: Galvanized steel, 1/4" minimum diameter for 36" length or less; 3/8" minimum dia. for lengths longer than 36".

### 2.2 DUCT LINER

- A. General: Comply with NFPA Standard 90A and TIMA Standard AHC-101.
- B. All supply ductwork, return and transfer air ductwork shall be lined. Dimensions shown indicate clear inside dimensions. Increase sheetmetal size as required. In addition, general exhaust ductwork shall be lined within 15'-0" from fan.
- C. Exceptions: Kitchen exhausts, kiln exhaust, fume hood exhaust.
- D. Materials: ASTM C 1071, Type II, with coated surface exposed to airstream to prevent erosion of glass fibers.
  - 1. Thickness: 1" (indoors), 2" (outdoors)
  - 2. Density: 1-1/2 pounds.
  - 3. Thermal Performance: "K-Factor" equal to 0.28 or better, at a mean temperature of 75°F.
  - 4. Fire Hazard Classification: Flame spread rating of not more than 25 without evidence of continued progressive combustion and a smoke developed rating of no higher than 50, when tested in accordance with ASTM C 411.
  - 5. Liner Adhesive: Comply with NFPA Standard 90A and ASTM C 916.
  - 6. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct. Provide fasteners that do not damage the liner when applied as recommended by the manufacturer, that do not cause leakage in the duct, and will indefinitely sustain a 50-pound tensile dead load test perpendicular to the duct wall.
  - 7. Fastener Pin Length: As required for thickness of insulation, and without projecting more than 1/8" into the airstream.

8. Adhesive for Attachment of Mechanical Fasteners: Comply with the "Fire Hazard Classification" of duct liner system.

### 2.3 SEALING MATERIALS

- A. Joint and Seam Sealants, General: The term sealant used here is not limited to materials of adhesive or mastic nature, but also includes tapes and combinations of open weave fabric strips and mastics. The contractor has the option of using "Duct-Mate" or similar sealing and joining the manufacturer's instruction.
- B. Joint and Seam Tape: 2" wide, glass-fiber-fabric reinforced.
- C. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant complying with FS TT-S-001657, Type I; formulated with a minimum of 75% solids.
- D. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

### 2.4 PREFABRICATED DOUBLE WALL DUCTWORK

- A. Furnish and install Acousti-K27 Double Wall Round Ductwork and Fittings as manufactured by United McGill Corporation or approved equal. Acousti-K27 duct and fittings shall be constructed of a perforated inner liner, a 2" layer of fiberglass insulation, and an outer pressure shell. Duct shall be of spiral lockseam construction, provided in standard lengths of 10'-0", 12'-0" or 20'-0" or otherwise as required, fabricated from galvanized steel meeting ASTM-A527 standards. Installation, connections and sealants shall be in strict accordance with manufacturer's requirements and recommendations. Outer shell shall be constructed of paintable steel.

### 2.5 FIRE-STOPPING

- A. Fire-Resistant Sealant: Provide one-part elastomeric sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
  1. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
  2. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
  3. "RTV 7403"; General Electric Co.
  4. "Fyre Putty"; Standard Oil Engineered Materials Co.
  5. Or approved equal.

### 2.6 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4" thick.



- B. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod.
  - 1. Hangers Installed In Corrosive Atmospheres: Electro-galvanized, all-thread rod or hot-dipped-galvanized rods with threads painted after installation.
  - 2. Straps and Rod Sizes: Conform with Table 4-1 in SMACNA HVAC Duct Construction Standards, 1985 Edition, for sheet steel width and gage and steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.
- E. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.
- F. For stainless steel ducts, provide stainless steel support materials.
- G. For aluminum ducts, provide aluminum support materials, except where materials are electrolytically separated from ductwork.

### PART 3 - PRODUCTS

#### 3.1 RECTANGULAR DUCT FABRICATION

- A. General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards," Tables 1-3 through 1-19, including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.
- B. Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
  - 1. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
- C. Fabricate kitchen hood exhaust ducts with 16-gauge, carbon steel sheets for concealed ducts and 18-gauge stainless steel for exposed ducts. Weld and flange seams and joints. Conform to NFPA Standard 96.
- D. Except as otherwise noted, transverse duct joints on all rectangular supply, exhaust and return air ductwork more than 16" in any dimension shall be made with the Ductmate System or an approved equal. The Ductmate System components shall be of standard catalog manufacture as supplied by Ductmate Industries, Inc.
- E. The installation of the Ductmate System shall be in accordance with the manufacturer's printed instruction and installation.
- F. The Ductmate System joint is the equivalent of SMACNA "J" connection and construction of the duct, such as gauge, reinforcing, etc., shall be indicated in the SMACNA manuals for the indicated pressure class.
  - 1. The Ductmate angle shall be securely fastened to the duct walls by either spot welding, tack screwing or riveting. Fastener spacing shall be as recommended in the manufacturer's installation manual for the applicable pressure class. The raw duct ends shall be properly seated in the integral mastic seal.
  - 2. A continuous strip of closed cell gasket tape, size 5/16" x 3/4" shall be installed between the mating flanges of the companion angles at each transverse joint and the joint shall be made up using 3/8" dia. x 1" long plated joints bolts and nuts. Drive-on or snap-on cleats shall be used at spacings as recommended in the manufacturer's installation manual.

3. Where Ductmate is not used all longitudinal joints shall be Pittsburgh or double lock seams hammered tight and shall be located above the horizontal axis of the duct.
  4. Transverse joints shall be made as airtight as possible with all laps in the direction of air flow.
  5. All fasteners and attachments shall be made of the same material as the ducts or of corrosion-resistant materials.
- G. Weather Resistant Ducts: Provide factory fabricated ducts and fittings only. No shop or field fabrications will be allowed.
- H. Static Pressure Classifications: Except where otherwise indicated, construct duct systems to the following pressure classifications:
1. Supply Ducts: 3" water gage minimum. For Air Handling Units with scheduled ESP over 2.75", but less than 5.75", construct to 6" water gage. For Air Handling Units with scheduled ESP over 5.75", construct to 10" water gage.
  2. Return Ducts: 2" water gage minimum, negative pressure. For fans with scheduled ESP over 1.75", but less than 4.75", construct to 5" water gage, negative pressure. For fans with scheduled ESP over 4.75", construct to 10" water gage.
  3. Exhaust Ducts: 2" water gage minimum, negative pressure. For fans with scheduled ESP over 1.75", but less than 4.75", construct to 5" water gage, negative pressure. For fans with scheduled ESP over 4.75", construct to 10" water gage.
- I. Leakage; ducts constructed in accordance with SMACNA Standards and in the Static Pressure Classifications noted above shall have a leakage less than 5% of system operating air flow.
- J. Crossbreaking or Cross Beading: Crossbreak or bead duct sides that are 19" and larger and are 20 gage or less, with more than 10 sq. ft. of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standard," Figure 1-4, unless they are lined or are externally insulated.

### 3.2 RECTANGULAR DUCT FITTINGS

- A. Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard," 1985 Edition, Figures 2-1 through 2-10.

### 3.3 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

- A. Adhere a single layer of indicated thickness of duct liner with 90% coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness is prohibited.
- B. Apply a coat of adhesive to liner facing in direction of airflow not receiving metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to assure butted edge overlapping.
- E. Longitudinal joints in rectangular ducts shall not occur except at corners of ducts, unless the size of the duct and standard liner product dimensions make longitudinal joints necessary.
- F. Apply an adhesive coating on longitudinal seams in ducts exceeding 2,500 FPM air velocity.
- G. Secure liner with mechanical fasteners 4" from corners and at intervals not exceeding 12" transversely around perimeter; at 3" from transverse joints and at intervals not exceeding 18" longitudinally.
- H. Secure transversely oriented liner edges facing the airstream with metal nosings that are either channel or "Z" profile or are integrally formed from the duct wall at the following locations:

1. Fan discharge.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts.

### 3.4 DUCT INSTALLATION, GENERAL

- A. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.
- B. Install ducts with the fewest possible joints.
- C. Use fabricated fittings for all changes in directions, changes in size and shape, and connections.
- D. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.
- E. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
- F. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Provide clearance of 1" where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.
- I. Install insulated ducts with 1" clearance outside of insulation.
- J. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.
- K. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1½".

### 3.5 SEAM AND JOINT SEALING

- A. General: Seal duct seams and joints as follows. Double tape all seams and joints specified to be sealed.
- B. Pressure Classifications Greater Than 3" Water Gage: All transverse joints, longitudinal seams, and duct penetrations.
- C. Pressure Classification 2" and 3" Water Gage: All transverse joints and longitudinal seams.
- D. Pressure Classification Less than 2" Water Gage: Transverse joints only.
- E. Seal externally insulated ducts prior to insulation installation.

### 3.6 HANGING AND SUPPORTING

- A. Install rigid round and rectangular metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards," Tables 4-1 through 4-3 and Figures 4-1 through 4-8.
- B. Support horizontal ducts within 2'-0" of each elbow and within 4'-0" of each branch intersection.
- C. Support vertical ducts at a maximum interval of 16'-0" and at each floor.

- D. Upper attachments to structures shall have an allowable load not exceeding  $\frac{1}{4}$  of the failure (proof test) load but are not limited to the specific methods indicated.
- E. Install concrete insert prior to placing concrete.
- F. Install powder actuated concrete fasteners after concrete is placed and completely cured.
- G. Equipment Connections: Connect equipment with flexible connectors in accordance with Division 23 Section "Air Duct Accessories."
- H. Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figures 2-7 and 2-8.
- I. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figures 2-16 through 2-18.
- J. Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figure 2-19.

### 3.7 PVC-COATED DUCT INSTALLATION (FUME HOOD EXHAUST DUCTS)

- A. Install PVC-coated duct and fittings in accordance with the manufacturer's instructions. United McGill Uni-Coat duct and fittings with 4 mil coating on both interior and exterior surfaces.
- B. Seal all joints and seams. Apply sealer to male end connectors before insertion, and afterwards to cover the entire joint and sheet metal screws.
- C. Secure couplings with sheet metal screws. Install screws at an interval of 12", with a minimum of three (3) screws in each coupling.
- D. Repair damage to PVC coating with PVC aerosol spray.

### 3.8 FIELD QUALITY CONTROL

- A. An independent testing agency shall perform, record, and report leakage tests.
- B. Remake leaking joints as required and apply sealants to achieve specified maximum allowable leakage.

### 3.9 ADJUSTING

- A. Adjust volume control devices as required by the testing and balancing procedures to achieve required airflow. Refer to Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for requirements and procedures for adjusting and balancing air systems.

END OF SECTION 23 31 13

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Backdraft and pressure relief dampers.
  2. Barometric relief dampers.
  3. Manual volume dampers.
  4. Control dampers.
  5. Fire dampers.
  6. Smoke dampers.
  7. Combination fire and smoke dampers.
  8. Flange connectors.
  9. Duct silencers.
  10. Turning vanes.
  11. Duct-mounted access doors.
  12. Flexible connectors.
  13. Flexible ducts.
  14. Duct accessory hardware.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Manual volume damper installations.
    - c. Control damper installations.
    - d. Fire-damper, smoke-damper, combination fire- and smoke-damper. Installations, including sleeves; and duct-mounted access doors and remote damper operators.
    - e. Wiring Diagrams: For power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- D. Source quality-control reports.
- E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

## 1.3 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

## 1.4 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fusible Links: Furnish quantity equal to 10% of amount installed.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90.
  - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and polished finish for exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4" minimum diameter for lengths 36" or less; 3/8" minimum diameter for lengths longer than 36".

## 2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- 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. Air Balance Inc.; a division of Mestek, Inc.
  - 2. American Warming and Ventilating; a division of Mestek, Inc.
  - 3. Ruskin Company.
  - 4. Or approved equal.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 1" wg.
- E. Frame: 0.063" thick extruded aluminum, with welded corners and mounting flange.
- F. Blades: Multiple single-piece blades, center-pivoted, maximum 6" width, 0.050" thick aluminum sheet with sealed edges.

- G. Blade Action: Parallel.
- H. Blade Seals: Neoprene, mechanically locked.
- I. Blade Axles:
  - 1. Material: Stainless steel.
  - 2. Diameter: 0.20”.
- J. Tie Bars and Brackets: Aluminum.
- K. Return Spring: Adjustable tension.
- L. Bearings: Steel ball or synthetic pivot bushings.
- M. Accessories:
  - 1. Adjustment device to permit setting for varying differential static pressure.
  - 2. Counterweights and spring-assist kits for vertical airflow installations.
  - 3. Electric actuators.
  - 4. Chain pulls.
  - 5. Screen Mounting: Front mounted in sleeve.
    - a. Sleeve Thickness: 20-gage minimum.
    - b. Sleeve Length: 6” minimum.
  - 6. Screen Mounting: Rear mounted.
  - 7. Screen Material: Aluminum.
  - 8. Screen Type: Bird.
  - 9. 90° stops.

### 2.3 BAROMETRIC RELIEF DAMPERS

- 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. Air Balance Inc.; a Division of Mestek, Inc.
  - 2. American Warming and Ventilating; a division of Mestek, Inc.
  - 3. Ruskin Company.
  - 4. Or approved equal.
- B. Suitable for horizontal or vertical mounting.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 2” wg.
- E. Frame: 0.064” thick, galvanized sheet steel, with welded corners and mounting flange.
- F. Blades:
  - 1. Multiple, 0.050” thick aluminum sheet.
  - 2. Maximum Width: 6”.
  - 3. Action: Parallel.
  - 4. Balance: Gravity.
  - 5. Eccentrically pivoted.
- G. Blade Seals: Neoprene.
- H. Blade Axles: Galvanized steel.
- I. Tie Bars and Brackets:
  - 1. Material: Galvanized steel.
  - 2. Rattle free with 90° stop.
- J. Return Spring: Adjustable tension.

- K. Bearings: Stainless steel.
- L. Accessories:
  - 1. Flange on intake.
  - 2. Adjustment device to permit setting for varying differential static pressures.

## 2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
  - 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. Air Balance Inc.; a division of Mestek, Inc.
    - b. American Warming and Ventilating; a division of Mestek, Inc.
    - c. Ruskin Company.
    - d. Or approved equal.
  - 2. Standard leakage rating.
  - 3. Suitable for horizontal or vertical applications.
  - 4. Frames:
    - a. Hat-shaped, galvanized-steel channels, 0.064" minimum thickness.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
  - 5. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064" thick.
  - 6. Blade Axles: Stainless steel.
  - 7. Bearings:
    - a. Oil-impregnated bronze.
    - b. Dampers in ducts with pressure classes of 3" wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  - 8. Tie Bars and Brackets: Galvanized steel.
- B. Standard, Aluminum, Manual Volume Dampers:
  - 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. Air Balance Inc.; a division of Mestek, Inc.
    - b. American Warming and Ventilating; a division of Mestek, Inc.
    - c. Ruskin Company.
    - d. Or approved equal.
  - 2. Standard leakage rating.
  - 3. Suitable for horizontal or vertical applications.
  - 4. Frames: Hat-shaped, 0.10" thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.



5. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Roll-Formed Aluminum Blades: 0.10" thick aluminum sheet.
  - e. Extruded-Aluminum Blades: 0.050" thick extruded aluminum.
6. Blade Axles: Stainless steel.
7. Bearings:
  - a. Oil-impregnated bronze.
  - b. Dampers in ducts with pressure classes of 3" wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Aluminum.

C. Jackshaft:

1. Size: 1" diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32" thick zinc-plated steel, and a 3/4" hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

## 2.5 CONTROL DAMPERS

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. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Ruskin Company.
4. Or approved equal.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. U shaped.
2. Galvanized-steel channels, 0.064" thick.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 8".
2. Opposed-blade design.
3. Galvanized steel.
4. 0.064" thick.
5. Retain one of two subparagraphs below.

6. Blade Edging: Closed-cell neoprene edging.
  7. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- E. Blade Axles: ½” diameter; stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From -40°F to 200°F.
- F. Bearings:
1. Oil-impregnated bronze.
  2. Dampers in ducts with pressure classes of 3” wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  3. Thrust bearings at each end of every blade.

## 2.6 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Air Balance Inc.; a division of Mestek, Inc.
  2. Arrow United Industries; a division of Mestek, Inc.
  3. Prefco; Perfect Air Control, Inc.
  4. Ruskin Company.
  5. Or approved equal.
- B. Type: Static; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4” wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034” thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.052” or 0.138” thick, as indicated, and of length to suit application.
  2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034” thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034” thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165°F rated, fusible links.

## 2.7 SMOKE DAMPERS

- 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. Air Balance Inc.; a division of Mestek, Inc.
  2. Ruskin Company.
  3. Arrow United Industries; a division of Mestek, Inc.
  4. Or approved equal.

- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Smoke Detector: Integral, factory wired for single-point connection.
- D. Frame: Multiple-blade type; fabricated with roll-formed, 0.034" thick galvanized steel; with mitered and interlocking corners.
- E. Blades: Roll-formed, horizontal, interlocking, 0.034" thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034" thick, galvanized-steel blade connectors.
- F. Leakage: Class I.
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Mounting Sleeve: Factory-installed, 0.052" thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- I. Damper Motors: two-position action.
- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
  - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC."
  - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
  - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at -40°F.
  - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
  - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- K. Accessories:
  - 1. Auxiliary switches for position indication.

## 2.8 COMBINATION FIRE AND SMOKE DAMPERS

- 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. Air Balance Inc.; a division of Mestek, Inc.
  - 2. Arrow Industries; a division of Mestek, Inc.
  - 3. Ruskin Company.
  - 4. Or approved equal.
- B. Type: Static and dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
- C. Closing rating in ducts up to 4" wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Multiple-blade type; fabricated with roll-formed, 0.034" thick galvanized steel; with mitered and interlocking corners.
- F. Heat-Responsive Device: Replaceable, 165°F rated, fusible links.

- G. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.
- H. Frame: Multiple-blade type; fabricated with roll-formed, 0.034" thick galvanized steel; with mitered and interlocking corners.
- I. Blades: Roll-formed, horizontal, interlocking, 0.034" thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034" thick, galvanized-steel blade connectors.
- J. Leakage: Class I.
- K. Rated pressure and velocity to exceed design airflow conditions.
- L. Mounting Sleeve: Factory-installed, 0.052" thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- M. Master control panel for use in dynamic smoke-management systems.
- N. Damper Motors: two-position action.
- O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
  - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC."
  - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
  - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at -40°F.
  - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
  - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- P. Accessories:
  - 1. Auxiliary switches for position indication.

## 2.9 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Ductmate Industries, Inc.
  - 2. Nexus PDQ; Division of Shilco Holdings Inc.
  - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
  - 4. Or approved equal.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

## 2.10 DUCT SILENCERS

- 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:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Industrial Noise Control, Inc.
  - 2. McGill AirFlow LLC.
  - 3. Ruskin Company.
  - 4. Vibro-Acoustics.
  - 5. Or approved equal.
- C. General Requirements:
  - 1. Factory fabricated.
  - 2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
  - 3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2013.
- D. Shape:
  - 1. Rectangular straight with splitters or baffles.
  - 2. Round straight with center bodies or pods.
  - 3. Rectangular elbow with splitters or baffles.
  - 4. Round elbow with center bodies or pods.
  - 5. Rectangular transitional with splitters or baffles.
- E. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel, 0.040" thick.
- F. Round Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel.
  - 1. Sheet Metal Thickness for Units up to 24" in Diameter: 0.034" thick.
  - 2. Sheet Metal Thickness for Units 26" – 40" in Diameter: 0.040" thick.
  - 3. Sheet Metal Thickness for Units 42" – 52" in Diameter: 0.052" thick.
  - 4. Sheet Metal Thickness for Units 54" – 60" in Diameter: 0.064" thick.
- G. Inner Casing and Baffles: ASTM A 653/A 653M, G90 galvanized sheet metal, 0.034" thick, and with 1/8" diameter perforations.
- H. Special Construction:
  - 1. Suitable for outdoor use.
  - 2. High transmission loss to achieve STC 45.
- I. Connection Sizes: Match connecting ductwork unless otherwise indicated.
- J. Principal Sound-Absorbing Mechanism:
  - 1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
  - 2. Film-lined type with fill material.
    - a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 15% compression.
    - b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.

3. Lining: Mylar or Tedlar.
- K. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
1. Lock form and seal or continuously weld joints.
  2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
  3. Reinforcement: Cross or trapeze angles for rigid suspension.
- L. Accessories:
1. Factory-installed end caps to prevent contamination during shipping.
  2. Removable splitters.
  3. Airflow measuring devices.
- M. Source Quality Control: Test according to ASTM E 477.
1. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
  2. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6" wg static pressure, whichever is greater.
- N. Capacities and Characteristics:
1. See schedule on the drawings.

## 2.11 TURNING VANES

- 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. Ductmate Industries, Inc.
  2. Duro Dyne Inc.
  3. METALAIRE, Inc.
  4. SEMCO Incorporated.
  5. Or approved equal.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- E. Vane Construction: Single wall for ducts up to 30" wide and double wall for larger dimensions.

## 2.12 DUCT-MOUNTED ACCESS DOORS

- 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. American Warming and Ventilating; a division of Mestek, Inc.
  2. Ductmate Industries, Inc.

3. Flexmaster U.S.A., Inc.
4. McGill AirFlow, LLC.
5. Or approved equal.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:
  - a. Double wall, rectangular.
  - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
  - c. Vision panel.
  - d. Hinges and Latches: 1" by 1" butt or piano hinge and cam latches.
  - e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
  - a. Access Doors Less Than 12" Square: No hinges and two sash locks.
  - b. Access Doors up to 18" Square: Two hinges and two sash locks.
  - c. Access Doors up to 24" by 48": Three hinges and two compression latches with outside and inside handles.
  - d. Access Doors Larger than 24" by 48": Four hinges and two compression latches with outside and inside handles.

## 2.13 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Ductmate Industries, Inc.
  2. Duro Dyne Inc.
  3. Ventfabrics, Inc.
  4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
  5. Or approved equal.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3½" wide attached to 2 strips of 2¾" wide, 0.028" thick, galvanized sheet steel or 0.032" thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  1. Minimum Weight: 26 oz./sq. yd.
  2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  3. Service Temperature: -40°F to 200°F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  1. Minimum Weight: 24 oz./sq. yd.
  2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
  3. Service Temperature: -50°F to 250°F.

- G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
1. Minimum Weight: 14 oz./sq. yd.
  2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
  3. Service Temperature: -67°F to 00°F.
- H. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30° of angular rod misalignment without binding or reducing isolation efficiency.
  2. Outdoor Spring Diameter: Not less than 80% of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50% of the required deflection at rated load.
  4. Lateral Stiffness: More than 80% of rated vertical stiffness.
  5. Overload Capacity: Support 200% of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  7. Coil Spring: Factory set and field adjustable for a maximum of ¼" movement at start and stop.

## 2.14 FLEXIBLE DUCTS

- 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. Flexmaster U.S.A., Inc.
  2. McGill AirFlow LLC.
  3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
  4. Or approved equal.
- B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
1. Pressure Rating: 10" wg positive and 1.0" wg negative.
  2. Maximum Air Velocity: 4000 fpm.
  3. Temperature Range: -10°F to 160°F.
  4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2013.
- C. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 10" wg positive and 1.0" wg negative.
  2. Maximum Air Velocity: 4000 fpm.
  3. Temperature Range: -20°F to 210°F.
  4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2013.
- D. Flexible Duct Connectors:
1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3" through 18", to suit duct size.



## 2.15 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  - 1. Install steel volume dampers in steel ducts.
  - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Connect ducts to duct silencers rigidly.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. On both sides of duct coils.
  - 2. At outdoor-air intakes and mixed-air plenums.
  - 3. At drain pans and seals.
  - 4. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
  - 5. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
  - 6. Control devices requiring inspection.
  - 7. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:
  - 1. One-Hand or Inspection Access: 8" by 5".
  - 2. Two-Hand Access: 12" by 6".
  - 3. Head and Hand Access: 18" by 10".

4. Head and Shoulders Access: 21" by 14".
  5. Body Access: 25" by 14".
  6. Body plus Ladder Access: 25" by 17".
- 
- L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
  - M. Install flexible connectors to connect ducts to equipment.
  - N. For fans developing static pressures of 5" wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
  - O. Connect terminal units to supply ducts with maximum 12" lengths of flexible duct. Do not use flexible ducts to change directions.
  - P. Connect diffusers or light troffer boots to ducts with maximum 60" lengths of flexible duct clamped or strapped in place.
  - Q. Connect flexible ducts to metal ducts with draw bands.
  - R. Install duct test holes where required for testing and balancing purposes.
  - S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4" movement during start and stop of fans.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  1. Operate dampers to verify full range of movement.
  2. Inspect locations of access doors and verify that purpose of access door can be performed.
  3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
  4. Inspect turning vanes for proper and secure installation.
  5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Rectangular and square ceiling diffusers.
  - 2. Perforated diffusers.
  - 3. Louver face diffusers.
  - 4. Linear bar diffusers.
  - 5. Linear slot diffusers.
  - 6. Ceiling-integral continuous diffusers.
  - 7. Drum louvers.
  - 8. Modular core supply grilles.
  - 9. Adjustable bar registers and grilles.
  - 10. Linear bar grilles.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Duct access panels.
- C. Source quality-control reports.

## PART 2 - PRODUCTS

## 2.1 CEILING DIFFUSERS

## A. Rectangular and Square Ceiling Diffusers (CD):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
  - a. Krueger.
  - b. Price Industries.
  - c. Tuttle & Bailey.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, white.
5. Face Size: 24" x 24" and 12" x 12".
6. Face Style: Four cone Plaque.
7. Mounting: T-bar or surface.
8. Pattern: Adjustable.
9. Dampers: Radial opposed blade.
10. Accessories:
  - a. Equalizing grid.
  - b. Plaster ring.
  - c. Sectorizing baffles.

## B. Perforated Diffuser (CD):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
  - a. Krueger.
  - b. Price Industries.
  - c. Tuttle & Bailey.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel backpan and pattern controllers, with steel face.
4. Finish: Baked enamel, white.
5. Face Size: 24" x 24".
6. Duct Inlet: Round.
7. Face Style: Flush or Drop extended.
8. Mounting: T-bar.
9. Pattern Controller: Four louvered deflector patches.
10. Dampers: Radial opposed blade.
11. Accessories:
  - a. Equalizing grid.
  - b. Plaster ring.
  - c. Sectorizing baffles.

## C. Louver Face Diffuser:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
  - a. Kruger.
  - b. Price Industries.
  - c. Tuttle & Bailey.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, white.
5. Face Size: 24" x 24".
6. Mounting: T-bar.
7. Pattern: One-way Two-way Three-way Four-way core style.
8. Dampers: Radial opposed blade.
9. Accessories:
  - a. Adjustable pattern vanes.
  - b. Equalizing grid.
  - c. Sectorizing baffles.

## 2.2 CEILING LINEAR SLOT OUTLETS

### A. Linear Bar Diffuser:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
  - a. Krueger.
  - b. Price Industries.
  - c. Tuttle & Bailey
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, color selected by Architect.
5. Wide Core Spacing Arrangement: 1/8" thick blades spaced 1/2" apart, 15° deflection.
6. Pencil-Proof Core Spacing Arrangement: 3/16" thick blades spaced 7/16" apart, 15° deflection.
7. One-Way Deflection Vanes: Extruded construction fixed louvers with removable core.
8. Frame: 1" wide.
9. Mounting: Countersunk screw, concealed bracket or spring clip.
10. Damper Type: Adjustable opposed-blade assembly.
11. Accessories: Alignment pins, Core clips and Blank-off strips.

### B. Linear Slot Diffuser (LD):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
  - a. Krueger.
  - b. Price Industries.
  - c. Tuttle & Bailey Titus.
  - d. Donco.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material - Shell: Steel,
4. Material - Pattern Controller and Tees: Aluminum.
5. Finish - Face and Shell: Baked enamel, black.
6. Finish - Pattern Controller: Baked enamel, black.
7. Finish - Tees: Baked enamel, white.
8. Slot Width:  $\frac{3}{4}$ ".
9. Number of Slots: Two.
10. Length: 48".
11. Accessories: T-bar slot Center notch.

C. Ceiling-Integral Continuous Diffuser:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
  - a. Krueger.
  - b. Price Industries.
  - c. Tuttle & Bailey.
2. Slot Width:  $\frac{3}{4}$ ".
3. Section Length: as indicated on drawings.
4. Straight and curved sections as required to accommodate layout.
5. Mitered tees and corners.
6. Pattern Controllers: 24" o.c.
7. Material: Aluminum, extruded, heavy wall.
8. Finishes:
  - a. Exterior: Standard white.
  - b. Interior: Standard black.
9. Mounting: Ceiling or Sidewall.
10. Plenum: Insulated.
11. Other Features:
  - a. Painted interior.
  - b. Blank-offs.

## 2.3 HIGH-CAPACITY DIFFUSERS

A. Drum Louver:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
  - a. Krueger.
  - b. Price Industries.
  - c. Tuttle & Bailey.
2. Airflow Principle: Extended distance for high airflow rates.
3. Material: Aluminum, heavy gage extruded.
4. Finish: White baked acrylic.
5. Border:  $1\frac{1}{4}$ " width with countersunk screw holes.

6. Gasket between drum and border.
7. Body: Drum shaped; adjustable vertically.
8. Blades: Individually adjustable horizontally.
9. Mounting: Surface to duct.
10. Inlet Width: 6" and 10".
11. Inlet Length: As shown on the drawings.
12. Accessories:
  - a. Opposed-blade steel damper.
  - b. Duct-mounting collars with countersunk screw holes.

B. Modular Core Supply Grilles:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
  - a. Krueger.
  - b. Price Industries.
  - c. Tuttle & Bailey.
2. Throw: Extended distance for airflow rates.
3. Material: Steel.
4. Grilles per Unit: One.
5. Finish: White baked acrylic.
6. Border: 1/2" width with countersunk screw holes.
7. Blades:
  - a. Set in modules.
8. Modules: Removable; rotatable.
9. Mounting: Surface.
10. Accessory: Opposed-blade steel damper.

## 2.4 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
  - a. Krueger.
  - b. Price Industries.
  - c. Tuttle & Bailey.
2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal spaced 1/2" apart.
5. Core Construction: Removable.
6. Rear-Blade Arrangement: Vertical spaced 1/2" apart.
7. Frame: 1" wide.
8. Mounting: Countersunk screw, concealed lay in.
9. Damper Type: Adjustable opposed blade.
10. Accessories:

- a. Front-blade gang operator.
- b. Filter.

B. Adjustable Bar Grille:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
  - a. Krueger.
  - b. Price Industries.
  - c. Tuttle & Bailey.
2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal spaced ½” apart.
5. Core Construction: Removable.
6. Rear-Blade Arrangement: Vertical spaced ¾” and ½” apart.
7. Frame: 1” wide.
8. Mounting: Countersunk screw, concealed lay in.

C. Linear Bar Grille:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
  - a. Krueger.
  - b. Price Industries.
  - c. Tuttle & Bailey.
2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: ½” x ½” x ½” grid core.
5. Distribution plenum.
  - a. Internal insulation.
  - b. Inlet damper.
6. Frame: 1” wide.
7. Mounting: Concealed.
8. Damper Type: Adjustable opposed blade.

D. For special model numbers and accessories, see schedule on drawings.

2.5 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."



### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

#### 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

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SECTION 23 81 26

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes compressor-condenser.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories, motor requirements, and electrical characteristics.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
  - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
  - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

1.5 COORDINATION

- A. Coordinate sizes and locations with actual equipment provided.
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. For Compressor: Five year(s) from date of Substantial Completion.
    - b. For Parts: Two year(s) from date of Substantial Completion.
    - c. For Labor: Two year(s) from date of Substantial Completion.

## 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. Mitsubishi electric
  2. Daikin.
  3. Lennox.

## 2.2 INDOOR UNITS

- A. Concealed Evaporator-Fan Components:
1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
  2. Insulation: Faced, glass-fiber duct liner.
  3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
  4. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1"; leak tested to 300 psig underwater; with a two-position control valve.
  5. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
  6. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
  7. Fan Motors:
    - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
    - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
  8. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
  9. Filters: Permanent, cleanable.
  10. Condensate Drain Pans:
    - a. Fabricated with slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
      - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1-2004.
      - 2) Depth: A minimum of 2" deep.
    - b. Single-wall, stainless-steel sheet.
    - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
      - 1) Minimum Connection Size: NPS 1".

- d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
- e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

## 2.3 OUTDOOR UNITS

### A. Air-Cooled, Compressor-Condenser Components:

- 1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
  - a. Compressor Type: Scroll.
  - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
  - c. Refrigerant Charge: R-410A.
  - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.
- 3. Fan: Aluminum-propeller type, directly connected to motor.
- 4. Motor: Permanently lubricated, with integral thermal-overload protection.
- 5. Low Ambient Kit: Permits operation down to 45°F.
- 6. Mounting Base: Polyethylene.

## 2.4 ACCESSORIES

- A. Control equipment and sequence of operation are specified in Sequence of.
- B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- C. Automatic-reset timer to prevent rapid cycling of compressor.
- D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- E. Capacities: See schedule on drawings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install roof-mounted, compressor-condenser components on equipment supports.
- C. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1". See Division 20 Section "Vibration Isolation and Seismic Restraints for HVAC, Fire Protection, Electrical and Plumbing".
- D. Install and connect refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

### 3.2 CONNECTIONS

- A. Connect refrigerant piping to coil with components furnished by unit manufacturer.

- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Prepare test and inspection reports.

### 3.4 STARTUP SERVICE

- A. Perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

### 3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 81 26

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work Included: The Work of this Section includes, but is not limited to the following:
  - 1. Electrical equipment coordination and installation.
  - 2. Sleeves for raceways and cables.
  - 3. Sleeve seals.
  - 4. Grout.
  - 5. Common electrical installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 07 84 00 "Firestopping."

## PART 2 - PRODUCTS

### 2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

### 2.2 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2" above finished floor level.
- G. Size pipe sleeves to provide 1/4" annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: 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 07 92 00 "Joint Sealants".



- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Section 07 84 00 "Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1" annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1" annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use 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.

### 3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Section 07 84 00 "Firestopping."

END OF SECTION 26 05 00

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work Included: The Work of this Section includes, but is not limited to the following:
  1. Building wires and cables rated 600 V and less.
  2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEC 2017.

1.5 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Alcan Products Corporation; Alcan Cable Division.
  2. American Insulated Wire Corp.; a Leviton Company.
  3. General Cable Corporation.
  4. Senator Wire & Cable Company.
  5. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW and SO.

- D. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC, metal-clad cable, Type MC and Type SO with ground wire.

## 2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. AFC Cable Systems, Inc.
  2. Hubbell Power Systems, Inc.
  3. O-Z/Gedney; EGS Electrical Group LLC.
  4. 3M; Electrical Products Division.
  5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052" or 0.138" thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 07 84 00 "Penetration Firestopping."

## 2.4 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements.
- D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  2. Pressure Plates: Stainless steel. Include two for each sealing element.
  3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper only. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.
- F. Feeders in Cable Tray: Type THHN-THWN, single conductors in raceway.
- G. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- J. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC.
- K. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC.
- L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- M. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- N. Class 2 Control Circuits: Type THHN-THWN, in raceway; Power-limited cable, concealed in building finishes; Power-limited tray cable, in cable tray.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. 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.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- G. Seal around all cable penetration through floor, walls or roofs.

### 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 and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

- C. Wiring at Outlets: Install conductor at each outlet, with at least 6" of slack.

### 3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 07 84 00 "Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve rectangle perimeter less than 50" and no side greater than 16", thickness shall be 0.052".
  - 2. For sleeve rectangle perimeter equal to, or greater than, 50" and 1 or more sides equal to, or greater than, 16", thickness shall be 0.138".
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors 2" above finished floor level.
- H. Size pipe sleeves to provide ¼" annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Section 07 92 00 "Joint Sealants."
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Section 07 84 00 "Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1" annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1" annular clear space between cable and sleeve for installing mechanical sleeve seals.

### 3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

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 Section 07 84 00 "Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the distribution panel for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- D. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work Included: The Work of this Section includes, but is not limited to the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 QUALITY ASSURANCE

- A. Comply with NEC 2017.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

## PART 2 - PRODUCTS

## 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  6. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16" diameter holes at a maximum of 8" o.c., in at least 1 surface.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. Fabco Plastics Wholesale Limited.
    - d. Seasafe, Inc.
  3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
  4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
  5. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel 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 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.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Hilti Inc.
      - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
  3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  6. Toggle Bolts: All-steel springhead type.
  7. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

## 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 except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacing's less than stated in NFPA 70. Minimum rod size shall be ¼" in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 50% in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1½" and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

## 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4" thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4" thick.
  - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4" larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes but is not limited to the raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEC 2017.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Alfex Inc.
  - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
  - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 5. Electri-Flex Co.

6. Manhattan/CDT/Cole-Flex.
  7. Maverick Tube Corporation.
  8. O-Z Gedney; a unit of General Signal.
  9. Wheatland Tube Company.
- C. Rigid Steel Conduit: ANSI C80.1.
- D. Aluminum Rigid Conduit: ANSI C80.5.
- E. IMC: ANSI C80.6.
- F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
  2. Coating Thickness: 0.040", minimum.
- G. EMT: ANSI C80.3.
- H. FMC: Zinc-coated steel.
- I. LFMC: Flexible steel conduit with PVC jacket.
- J. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
  2. Fittings for EMT: Set-screw or compression type.
  3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040", with overlapping sleeves protecting threaded joints.
- K. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

## 2.2 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
  2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  3. Arnco Corporation.
  4. CANTEX Inc.
  5. CertainTeed Corp.; Pipe & Plastics Group.
  6. Condux International, Inc.
  7. ElecSYS, Inc.
  8. Electri-Flex Co.
  9. Lamson & Sessions; Carlon Electrical Products.
  10. Manhattan/CDT/Cole-Flex.
  11. RACO; a Hubbell Company.
  12. Thomas & Betts Corporation.
- C. ENT: NEMA TC 13.
- D. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- E. LFNC: UL 1660.
- F. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.



- G. Fittings for LFNC: UL 514B.

## 2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Arnco Corporation.
  2. Endot Industries Inc.
  3. IPEX Inc.
  4. Lamson & Sessions; Carlon Electrical Products.
- C. Description: Comply with UL 2024; flexible type, approved for general-use installation.

## 2.4 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Cooper B-Line, Inc.
  2. Hoffman.
  3. Square D; Schneider Electric.
- C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 12 or 3R, unless otherwise indicated.
- D. Fittings and Accessories: Include 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.
- E. Wireway Covers: Screw-cover type.
- F. Finish: Manufacturer's standard enamel finish.

## 2.5 NONMETALLIC WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Hoffman.
  2. Lamson & Sessions; Carlon Electrical Products.
- C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

- E. Fittings and Accessories: Include 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.

## 2.6 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Prime coating, ready for field painting.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Thomas & Betts Corporation.
    - b. Walker Systems, Inc.; Wiremold Company (The).
    - c. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Butler Manufacturing Company; Walker Division.
    - b. Enduro Systems, Inc.; Composite Products Division.
    - c. Hubbell Incorporated; Wiring Device-Kellems Division.
    - d. Lamson & Sessions; Carlon Electrical Products.
    - e. Panduit Corp.
    - f. Walker Systems, Inc.; Wiremold Company (The).
    - g. Wiremold Company (The); Electrical Sales Division.

## 2.7 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 2. EGS/Appleton Electric.
  - 3. Erickson Electrical Equipment Company.
  - 4. Hoffman.
  - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  - 6. O-Z/Gedney; a unit of General Signal.
  - 7. RACO; a Hubbell Company.
  - 8. Robroy Industries, Inc.; Enclosure Division.
  - 9. Scott Fetzer Co.; Adalet Division.
  - 10. Spring City Electrical Manufacturing Company.
  - 11. Thomas & Betts Corporation.
  - 12. Walker Systems, Inc.; Wiremold Company (The).

13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
  - D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.
  - E. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
  - F. Metal Floor Boxes: Sheet metal, semi-adjustable, rectangular.
  - G. Nonmetallic Floor Boxes: Nonadjustable, round.
  - H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
  - I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
  - J. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
    - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
    - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
  - 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.

## 2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Manholes shall be constructed in accordance with the requirements of the effected utility company.
- B. Description: Comply with SCTE 77.
  - 1. Color of Frame and Cover: Green.
  - 2. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
  - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 5. Cover Legend: Molded lettering, "ELECTRIC.", "TELEPHONE.", as indicated for each service.
  - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  - 7. Handholes 12" wide x 24" long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- C. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. Armorcast Products Company.
  - b. Carson Industries LLC.
  - c. CDR Systems Corporation.
  - d. NewBasis.
  
- D. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. Christy Concrete Products.
    - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
  
- E. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of cast iron.
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Carson Industries LLC.
    - b. Christy Concrete Products.
    - c. Nordic Fiberglass, Inc.

## 2.9 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052" or 0.138" thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 07 84 00 "Firestopping."

## 2.10 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
- D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM, NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.11 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 a 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.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
  - 1. Exposed Conduit: Rigid steel conduit, IMC.
  - 2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC, EMT RNC, Type EPC-40-PVC.
  - 3. Underground Conduit: RNC, Type EPC-80-PVC, direct buried.
  - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or 4.
  - 6. Application of Handholes and Boxes for Underground Wiring:
    - a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
    - b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer-concrete frame and cover, SCTE 77, Tier 8 structural load rating.

- c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only:  
Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
  2. Exposed, Not Subject to Severe Physical Damage: EMT.
  3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.
  4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  6. Damp or Wet Locations: Rigid steel conduit or IMC.
  7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
  8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
  9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
  10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.
- C. Minimum Raceway Size: ¾" trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
  2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits in contact with concrete.

### 3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6" 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. Support raceways as specified in Section 26 05 29 "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90° bends in any conduit run except for communications conduits, for which fewer bends are allowed.

- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
1. Run conduit larger than 1" trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- I. 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.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12" of slack at each end of pull wire.
- L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
1. 3/4" Trade Size and Smaller: Install raceways in maximum lengths of 50'-0".
  2. 1" Trade Size and Larger: Install raceways in maximum lengths of 75'-0".
  3. Install with a maximum of two 90° bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations 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 at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where otherwise required by New York City Electrical Code.
- N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30°F, and that has straight-run length that exceeds 25'-0".
1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125°F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155°F temperature change.
    - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125°F temperature change.
    - d. Attics: 135°F temperature change.
  2. Install fitting(s) that provide expansion and contraction for at least 0.00041" per foot of length of straight run per deg F of temperature change.
  3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

- O. Flexible Conduit Connections: Use maximum of 72" of flexible conduit for recessed and semirecessed lighting fixtures, 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.
- P. 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.
- Q. Set metal floor boxes level and flush with finished floor surface.
- R. 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 in Division 31 Section "Earth Moving" for pipe less than 6" in nominal diameter.
  - 2. Install backfill as specified in Division 31 Section "Earth Moving."
  - 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" of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
  - 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
  - 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3" of concrete.
    - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60" from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
  - 6. Warning Planks: Bury warning planks approximately 12" above direct-buried conduits, placing them 24" o.c. Align planks along the width and along the centerline of conduit.

### 3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from ½" sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1" above finished grade.
- D. Install handholes and boxes with bottom below the frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm



lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 07 84 00 "Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve cross-section rectangle perimeter less than 50" and no side greater than 16", thickness shall be 0.052".
  - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50" and 1 or more sides equal to, or greater than, 16", thickness shall be 0.138".
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2" above finished floor level.
- H. Size pipe sleeves to provide ¼" annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Section 07 92 00 "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Section 07 84 00 "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1" annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1" annular clear space between raceway and sleeve for installing mechanical sleeve seals.

### 3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Section 07 84 00 "Penetration Firestopping."

END OF SECTION 26 05 33

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work Included: The Work of this Section includes, but is not limited to the following:
  1. Identification for conductors and communication and control cable.
  2. Underground-line warning tape.
  3. Warning labels and signs.
  4. Instruction signs.
  5. Equipment identification labels.
  6. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NEC 2017
- C. Comply with 29 CFR 1910.145.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  1. Not less than 6" wide by 4 mils thick.
  2. Compounded for permanent direct-burial service.
  3. Embedded continuous metallic strip or core.
  4. Printed legend shall indicate type of underground line.

## 2.2 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. ¼" grommets in corners for mounting. Nominal size, 7" x 10".
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396" galvanized-steel backing; and with colors, legend, and size required for application. ¼" grommets in corners for mounting. Nominal size, 10" x 14".
- E. Warning label and sign 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 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16" thick for signs up to 20 sq. in. and 1/8" thick for larger sizes.
  - 1. Engraved legend with black letters on white face
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8".
- B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1".

## 2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16".
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: -40°F to 185°F.
  - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Section 09 90 00 "Painting and Coating".
- C. 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 APPLICATION

- A. Raceways and Duct Banks More Than 600 V Concealed within Buildings: 4" wide black stripes on 10" centers over orange background that extends full length of raceway or duct and is 12" wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3" high black letters on 20" centers. Stop stripes at legends. Apply to the following finished surfaces:
1. Floor surface directly above conduits running beneath and within 12" of a floor that is in contact with earth or is framed above unexcavated space.
  2. Wall surfaces directly external to raceways concealed within wall.
  3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A Identify with orange self-adhesive vinyl label.
- C. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded self-adhesive vinyl tape applied in bands:
1. Fire Alarm System: Red.
  2. Fire-Suppression Supervisory and Control System: Red and yellow.
  3. Combined Fire Alarm and Security System: Red and blue.
  4. Security System: Blue and yellow.
  5. Mechanical and Electrical Supervisory System: Green and blue.
  6. Telecommunication System: Green and yellow.
  7. Control Wiring: Green and red.
- D. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use aluminum wraparound marker. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- E. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use write-on tags. Identify each ungrounded conductor according to source and circuit number.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

- a. Power transfer switches.
  - b. Controls with external control power connections.
2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- I. Instruction Signs:
    1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
    2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum  $\frac{3}{8}$ " high letters for emergency instructions at equipment used for power transfer
  - J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
    1. Labeling Instructions:
      - a. Indoor Equipment Self-adhesive, engraved, laminated acrylic or melamine. Unless otherwise indicated, provide a single line of text with  $\frac{1}{2}$ " high letters on  $1\frac{1}{2}$ " high label; where 2 lines of text are required, use labels 2" high.
      - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
      - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    2. Equipment to Be Labeled:
      - a. Panelboards, electrical cabinets, and enclosures.
      - b. Access doors and panels for concealed electrical items.
      - c. Electrical switchgear and switchboards.
      - d. Transformers.
      - e. Electrical substations.
      - f. Emergency system boxes and enclosures.
      - g. Motor-control centers.
      - h. Disconnect switches.
      - i. Enclosed circuit breakers.
      - j. Motor starters.
      - k. Push-button stations.
      - l. Power transfer equipment.
      - m. Contactors.
      - n. Remote-controlled switches, dimmer modules, and control devices.
      - o. Battery inverter units.
      - p. Battery racks.
      - q. Power-generating units.
      - r. Voice and data cable terminal equipment.
      - s. Master clock and program equipment.

- t. Intercommunication and call system master and staff stations.
- u. Television/audio components, racks, and controls.
- v. Fire-alarm control panel and annunciators.
- w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
- x. Monitoring and control equipment.
- y. Uninterruptible power supply equipment.
- z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6” to 8” below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16” overall.
- H. Painted Identification: Prepare surface and apply paint according to Section 09 90 00 “Painting and Coating”.

END OF SECTION 26 05 53

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

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## SECTION 26 27 26

### WIRING DEVICES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Work Included: The Work of this Section includes, but is not limited to the following:
  1. Receptacles, receptacles with integral GFCI, and associated device plates.
  2. Twist-locking receptacles.
  3. Receptacles with integral surge suppression units.
  4. Wall-box motion sensors.
  5. Isolated-ground receptacles.
  6. Hospital-grade receptacles.
  7. Snap switches and wall-box dimmers.
  8. Solid-state fan speed controls.
  9. Wall-switch and exterior occupancy sensors.
  10. Floor service outlets, poke-through assemblies, service poles, and multi outlet assemblies.

##### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

##### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEC 2017.

##### 1.5 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  1. Cord and Plug Sets: Match equipment requirements.

## 1.6 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Service/Power Poles: One for every 10 but no fewer than one.
  2. Floor Service Outlet Assemblies: One for every 10 but no fewer than one.
  3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
  4. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.
  5. Wall switch occupancy sensor One for every 10 of each type installed, but no fewer than two of each type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
  2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  3. Leviton Mfg. Company Inc. (Leviton).
  4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

### 2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; 5361 (single), 5362 (duplex).
    - b. Hubbell; HBL5351 (single), CR5352 (duplex).
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; 8300 (duplex).
    - b. Hubbell; HBL8310 (single), HBL8300H (duplex).
    - c. Leviton; 8310 (single), 8300 (duplex).
    - d. Pass & Seymour; 9301-HG (single), 9300-HG (duplex).
- C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Hubbell; CR 5253IG.

- b. Leviton; 5362-IG.
  - c. Pass & Seymour; IG6300.
2. 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.
- D. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; TR8300.
    - b. Hubbell; HBL8300SG.
    - c. Leviton; 8300-SGG.
    - d. Pass & Seymour; 63H.
  2. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

### 2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; GF20.
    - b. Pass & Seymour; 2084.
- C. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; HGF20.
    - b. Hubbell; HGF8300.
    - c. Leviton; 6898-HG.
    - d. Pass & Seymour; 2091-SHG.

### 2.4 TVSS RECEPTACLES

- A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
  2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

- B. Duplex TVSS Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; 5362BLS.
    - b. Hubbell; HBL5362SA.
    - c. Leviton; 5380.
  2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
- C. Isolated-Ground, Duplex Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; IG5362BLS.
    - b. Hubbell; IG5362SA.
    - c. Leviton; 5380-IG.
  2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. 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.
- D. Hospital-Grade, Duplex Convenience Receptacles: Comply with UL 498 Supplement SD.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; 8300BLS.
    - b. Hubbell; HBL8362SA.
    - c. Leviton; 8380.
  2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
- E. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; IG8300HGBLS.
    - b. Hubbell; IG8362SA.
    - c. Leviton; 8380-IG.
  2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Comply with UL 498 Supplement SD. 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.

## 2.5 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; L520R.

- b. Hubbell; HBL2310.
- c. Leviton; 2310.
- d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Hubbell; IG2310.
  - b. Leviton; 2310-IG.
2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. 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.

## 2.6 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
  2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

## 2.7 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30%.
  2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## 2.8 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
    - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

- C. Pilot Light Switches, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; 2221PL for 120 V and 277 V.
    - b. Hubbell; HPL1221PL for 120 V and 277 V.
    - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
    - d. Pass & Seymour; PS20AC1-PLR for 120 V.
  2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120/277 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; 2221L.
    - b. Hubbell; HBL1221L.
    - c. Leviton; 1221-2L.
    - d. Pass & Seymour; PS20AC1-L.
  2. 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.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; 1995.
    - b. Hubbell; HBL1557.
    - c. Leviton; 1257.
    - d. Pass & Seymour; 1251.
- 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.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; 1995L.
    - b. Hubbell; HBL1557L.
    - c. Leviton; 1257L.
    - d. Pass & Seymour; 1251L.

## 2.9 OCCUPANCY SENSORS

- A. Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; 6111 for 120 V, 6117 for 277 V.
    - b. Hubbell; WS1277.
    - c. Leviton; ODS 10-ID.
    - d. Pass & Seymour; WS3000.
    - e. Watt Stopper (The); WS-200.
    - f. Sensorswitch

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180° field of view, with a minimum coverage area of 900 sq. ft..
- B. Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Hubbell; AT120 for 120 V, AT277 for 277 V.
    - b. Leviton; ODS 15-ID.
    - c. Sensorswitch
  2. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180° field of view, with a minimum coverage area of 900 sq. ft..
- C. Long-Range Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Hubbell; ATP1600WRP.
    - b. Leviton; ODWWV-IRW.
    - c. Pass & Seymour; WA1001.
    - d. Watt Stopper (The); CX-100.
    - e. Sensorswitch
  2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110° field of view, with a minimum coverage area of 1200 sq. ft..
- D. Long-Range Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Hubbell; ATD1600WRP.
    - b. Leviton; ODW12-MRW.
    - c. Watt Stopper (The); DT-200.
    - d. Sensorswitch
  2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110° field of view, and a minimum coverage area of 1200 sq. ft..
- E. Wide-Range Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Hubbell; ATP120HBRP.
    - b. Leviton; ODWHB-IRW.
    - c. Pass & Seymour; HS1001.
    - d. Watt Stopper (The); CX-100-3.
    - e. Sensorswitch
  2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150° field of view, with a minimum coverage area of 1200 sq. ft..
- F. Exterior Occupancy Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Leviton; PS200-10.
  - b. Watt Stopper (The); EW-100-120.
  - c. Sensorswitch
2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180° field of view, and 110-foot detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

## 2.10 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
  1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: Steel with white baked enamel suitable for field painting]
  3. Material for Unfinished Spaces: Galvanized steel
  4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant thermoplastic with lockable cover.
- C. Exterior and Demising Wall, Use Cardinal brand insulated outlet covers instead of conventional outlet covers [http://www.energyfederation.org/consumer/default.php/cPath/21\\_1272\\_61](http://www.energyfederation.org/consumer/default.php/cPath/21_1272_61)

## 2.11 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: solid brass with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable.

## 2.12 POKE-THROUGH ASSEMBLIES

- 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. Hubbell Incorporated; Wiring Device-Kellems.
  2. Pass & Seymour/Legrand; Wiring Devices & Accessories.
  3. Square D/ Schneider Electric.
  4. Thomas & Betts Corporation.
  5. Wiremold Company (The).
- B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
  1. Service Outlet Assembly: Flush type with four simplex receptacles and space for four RJ-45 jacks.
  2. Size: Selected to fit nominal 4" cored holes in floor and matched to floor thickness.
  3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.



4. Closure Plug: Arranged to close unused 4" cored openings and reestablish fire rating of floor.
5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, 4-pair, Category 5e voice and data communication cables.

#### 2.13 MULTIOUTLET ASSEMBLIES

- 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. Hubbell Incorporated; Wiring Device-Kellems.
  2. Wiremold Company (The).
- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard finish or PVC.
- D. Wire: No. 12 AWG.

#### 2.14 SERVICE POLES

- A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
  1. Poles: Nominal 2.5" square cross section, with height adequate to extend from floor to at least 6" above ceiling, and with separate channels for power wiring and voice and data communication cabling.
  2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
  3. Finishes: Manufacturer's standard painted finish and trim combination.
  4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
  5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.
  6. Voice and Data Communication Outlets: Four RJ-45 Category 5e jacks.

#### 2.15 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate 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. TVSS Devices: Blue.
  4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.
  5. Wiring Devices Connected to Technology Systems Gray.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  - 1. Take steps to insure that devices and their boxes are protected. 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 the 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 just 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. Pigtail existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
  - 1. Replace all devices that have been in temporary use during construction or that show signs that they 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" in length.
  - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
  - 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
  - 7. When conductors larger than No. 12 AWG are installed on 15-A 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.

2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- 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 and with grounding terminal of receptacles on top. 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.
- J. Exterior and Demising Wall:
  1. Install Putty Pads - <http://www.acousticalsolutions.com/firestop-putty-pads3>
  2. Use Cardinal brand insulated outlet covers instead of conventional outlet covers [http://www.energyfederation.org/consumer/default.php/cPath/21\\_1272\\_61](http://www.energyfederation.org/consumer/default.php/cPath/21_1272_61)
  3. Caulk outlet plate to sheetrock.
  4. No outlets to be placed back to back on demising walls.

### 3.2 IDENTIFICATION

- A. Comply with Section 26 05 53 "Identification for Electrical Systems."
  1. Receptacles: Identify panelboard and circuit number from which served. Use engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
  1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
  2. Test Instruments: Use instruments that comply with UL 1436.
  3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. 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% or higher is not acceptable.
  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. The 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.

04 December 2019

Lakewood Fire District No. 1  
Renovations at 733 Cedarbridge  
PSA 8193

END OF SECTION 26 27 26