## LABORERS' INTERNATIONAL UNION OF NORTH AMERICA LOCAL UNION #120

5440 LAFAYETTE ROAD INDIANAPOLIS, IN 46225



DECEMBER 21, 2021





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- 1.1 PROJECT MANUAL Review Set Not for Construction
  - A. New Union Hall.
  - B. LiUNA Local 120.
  - C. 1520 East Riverside Dr., Indianapolis, Indiana 46202.
  - D. Architect Project No. 21102.
  - E. arcDESIGN, PC.
  - F. 201 N. Delaware St. Suite B.
  - G. Indianapolis, IN 46204 .
  - H. Phone: (317) 951-9192.
  - I. Website: www.arcdesign.us .
  - J. Issued: December 21, 2021.
  - K. Copyright 2021 arcDESIGN, PC . All rights reserved.

END OF DOCUMENT 00 01 01

#### DOCUMENT 00 11 16 - INVITATION TO BID

#### 1.1 PROJECT INFORMATION

- A. Notice to Bidders: Prequalified bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.
- B. Project Identification: Laborer's International Union Local #120 New Union Hall.
   1. Project Location: 5440 Lafayette Rd., Indianapolis, IN 46254.
- C. Owner: Laborer's International Union of North America Local Union #120 Indianapolis, IN.
  1. Owner's Representative: Mr. Ward Daniels.
- D. Architect: arcDESIGN, PC.
  - 1. Architect's Representative: Greg Miller, Project Manager (317) 951-9192.
- E. General Contractor: Hannig Construction, Inc.
  1. General Contractor's Representative: Bill Hann, Vice President (812) 235-6218.
- F. Project Description: Project consists of New Union Hall and Site Construction.
- G. Construction Contract: Bids will be received for the following Work:1. All trades.
- H. Labor Requirement: This project is to be constructed with 100% Union Labor NO EXCEPTIONS. If you are unable to provide union labor for this project, please do not submit a proposal for the work.

#### 1.2 BID SUBMITTAL AND OPENING

- A. Hannig Construction Inc. will receive bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:
  - 1. Bid Date: Tuesday, January 18, 2022.
  - 2. Bid Time: 12:00 PM, local time.
  - 3. Location: Hannig Construction, Inc., Attention: Bill Hann. Bids will be received by email (bhann@hannigconstruction.com) or fax (812-235-1218).
- B. Bids will be thereafter privately opened and reviewed.

#### 1.3 PREBID CONFERENCE

A. A prebid conference for all bidders will be held at the Laborer's International Local Union #120, 1520 Riverside Drive, Indianapolis, IN 46202 on Wednesday, January 5, 2022 at 2:00pm local time. Following the prebid a jobsite visit will be conducted at the project site, 5440 Lafayette Rd., Indianapolis, IN 46254. Please wear a mask into and during the pre-bid conference and use social distancing in as much as possible.

#### 1.4 DOCUMENTS

- A. Documents are available from Hannig Construction, Inc. A link providing access will be sent with an Invitation to Bid through iSqFt. You do not have to have an iSqFt account to gain access. They will also be available on Hannig Construction's website under 'Private Projects' at www.hannigbidding.com.
- 1.5 TIME OF COMPLETION
  - A. Bidders shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time. Anticipated start date is March 1, 2022 with a construction duration of approximately 10 months.
- 1.6 BIDDER'S QUALIFICATIONS
  - A. Bidders must be properly licensed under the laws governing their respective trades. Insurance in a form acceptable to the Owner will be required of the successful Bidder.

END OF DOCUMENT 00 11 16

#### DOCUMENT 00 20 00 - GENERAL CONDITIONS

PART 1 - GENERAL

1.1 Summary: A Sample AIA A201-2017 is attached to this section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 00 20 00

#### DOCUMENT 00 20 20 - SUPPLEMENTARY GENERAL CONDITIONS

#### PART 1 - SUPPLEMENTARY GENERAL CONDITIONS

#### 1.1 DEFINITIONS

- A. "Contract". The Contract or Agreement, Invitation to Bidders, the Bid or Proposal, the General Conditions, the Supplementary Conditions, the Specification and Drawings, also any Addenda or the Modifications incorporated in any of the above documents before the execution of the Contract or Agreement.
- B. "Owner": Laborer's International Union Local 120.
- C. "Architect/Engineer": the individual or firm hired by the Owner to prepare the Construction Documents and to Administer the Contract.
- D. "Contractor": The person, firm or corporation who, with the Owner, executes the Contract, or the duly recognized assignee thereof.
- E. "Subcontractor": A person, firm or corporation who, under contract with Contractor, furnished material only, labor and materials, or labor only, at the site of or for the project.
- F. "Director": The Director of Department of Facilities Management at Indiana State University, or his duly authorized representative.
- G. "Surety": Any person, firm or corporation which has executed, as surety, the Contractor's performance bond securing the performance of the within contracts.
- H. "Work": Includes both materials and labor.

#### 1.2 INSURANCE

- A. The Prime Contractor(s) shall provide all insurances listed here-in in these Specifications and shall require the Subcontractor(s)/Suppliers (who will be onsite with their own personnel/vehicles) to provide the same. The Prime Contractor(s) shall not commence work under this Contract until they have obtained all insurance required by these specifications and until such insurance has been approved by the Owner, nor shall the Contractor allow any Subcontractor to commence work on his subcontract until all similar insurance required of the Subcontractor has been obtained. Policies expiring on a fixed date before final acceptance of the project must be renewed and evidence of such renewal submitted to the Owner before such date.
- B. The Prime Contractor(s) shall furnish the Owner with satisfactory evidence of the insurance required, with satisfactory compliance as determined solely by Owner.
- C. It is solely the responsibility of the Prime Contractor(s) to confirm that the Subcontractor(s) are in compliance with the insurance requirements of these Specifications, to maintain copies of

the Subcontractors insurance on file and to be prepared to provide evidence of these insurances to the Owner upon demand.

- D. Insurance Required:
  - 1. Worker's Compensation and Employers Insurance:
    - The Prime Contractor(s) shall maintain during the life of this contract Worker's а. Compensation and Employers Liability Insurance for all Prime Contractor's employees employed at or involved in any manner with the project, and, in case any work is sublet, the Prime Contractor(s) shall require the Subcontractor(s), at their own expense, similarly to provide Worker's Compensation and Employers Liability Insurance for all of the Subcontractor's employees engaged in or involved in any manner with work under this contract. Such Workers' Compensation insurance will be in accordance with the statutory requirements of the State of Indiana, with and including Worker's Compensation for All Other States, if any. The Prime Contractor(s) shall and require Subcontractor(s) to provide insurance coverage equal to that provided under the Worker's Compensation Act, for the protection of the Contractor's employees not otherwise protected. Employer's liability coverage must be maintained in amounts not less than \$500,000/\$500,000/\$500,000. Limits may be provided through a single policy or a primary/excess policy basis.
  - 2. Commercial General Liability Insurance.
    - a. The Contractor shall and require Subcontractors, at their own expense respectively, to maintain during the life of this contract Commercial General Liability Insurance insuring the Prime Contractor and any subcontractor, and owner and any other party required to be insured, from claims for bodily injury, death, personal injury and property damage which may arise from or on account of operations under this Contract, whether such operations be by the Prime Contractor(s) or by any Subcontractor or by anyone directly or indirectly employed by either of them and the amounts of such insurance shall be as follows:
      - 1) \$2,000,000General Aggregate
      - 2) \$1,000,000Combined Single Limit Bodily Injury, Property Damage
      - 3) \$1,000,000Products/Completed Operations
      - 4) \$1,000,000Personal Injury and Advertising Injury
      - 5) \$ 100,000Fire Damage
    - b. The General Aggregate limit shall apply separately, in total, to this project only.
  - 3. Business Auto Insurance:
    - a. The Prime Contractor(s) shall and shall require all Subcontractors to maintain at their own expense respectively, at all times during the life of this contract, business auto insurance covering all liability and claims arising from the ownership, use, maintenance, operation, loading or unloading of automobiles anywhere in the United States, in connection with the performance of the Contract, whether such automobiles are owned, hired, or non-owned by the Contractor or Subcontractors.
    - b. Such auto insurance shall be written with a limit of not less than \$1,000,000 per occurrence as a combined single limit for Bodily Injury and Property Damage coverage.

- 4. Umbrella Liability Insurance:
  - a. The Prime Contractor(s) shall and shall require all Subcontractors to maintain at their own expense respectively, at all times during the life of this Contract, Umbrella Liability Insurance providing excess coverage over the above specified primary insurance in an amount not less than:
    - 1) \$1,000,000 for contracts \$50,000 to \$99,999.99
    - 2) \$2,000,000 for contracts \$100,000 to \$999,999.99
    - 3) \$3,000,000 for contracts \$ 1,000,000 to \$2,999,999.99
    - 4) \$5,000,000 for contracts over \$3,000,000
- E. Additional Insurance Requirements:
  - 1. The Prime Contractor(s) shall and shall require all Subcontractors to Laborer's International Union Local 120, Hannig Construction, Inc. and any Architect/Engineer/Consultant Firm hired by the Owner for the Project, as an additional insured on their Commercial General Liability, Business Auto and Umbrella/Excess Liability policies with regard to this contract.
  - 2. Certificate(s) of Insurance shall include an endorsement of a Waiver of Subrogation in favor of the Owner for Commercial General Liability Insurance, Umbrella Liability Insurance, Worker's Compensation and Employers Liability Insurance and Business Auto Insurance.
  - 3. A copy of the applicable pages from the Contractor's policy shall be provided showing the endorsements listed in paragraphs 1 and 2 of this Item 1.03 E.
  - 4. With regard to the above mentioned Commercial General Liability, Business Auto, and Umbrella Liability Insurance, if in the event of any major change or cancellation of such policy, the Prime Contractor(s) shall and shall require all Subcontractors to give a 30-day advance notice to the Owner.
  - 5. The Prime Contractor(s) shall and shall require of all Subcontractors that the insurance companies must have an A.M. Best's rating of not less than an "A" for projects over \$150,000 and a rating of B+ or higher for projects under \$150,000 and that the insurance companies are duly licensed or authorized in the jurisdiction in which the Project is located to issue insurance policies for the limits and coverages so required.
- F. Builders Risk Insurance:
  - 1. The Owner agrees to provide property insurance including Builders Risk insurance for property under construction, and all materials and labor at or within 1,000 feet of the site intended for use in the "work" or project. Pursuant to this agreement, Owner hereby affirms the policy contains a waiver of subrogation in favor of the contractor or subcontractors should loss or damage of the type insured against result in loss to covered property; and Owner agrees to release from liability the contractor, to the extent such loss or damage is insured by said policy.
  - 2. Coverage does not extend to personal property, tools, equipment, scaffolding, staging, or similar equipment of the contract or subcontractor(s), or any employees thereof.
  - 3. Notwithstanding the foregoing however, Hannig Construction Inc. is responsible for the property insurance deductible of \$25,000 applicable to each covered loss to the work or project. Contractor acknowledges and affirms it will, without delay, pay the deductible, or if the loss remains within the deductible, pay that part of the deductible that equals the loss amount.

- G. Indemnification:
  - 1. The Prime Contractor shall and shall require Subcontractors to indemnify the Owner and any other party required to be insured from all claims arising from the failure of the Prime Contractor(s) to require the Subcontractors to provide the insurance required by these Specifications.
  - 2. Notwithstanding any other provision to the contrary, the Contractor(s) agree to indemnify the Owner only for losses due to personal injury, or property damage to the extent caused by Contractor's negligent acts or omissions, or the negligent acts or omissions of Contractor's employees, agents and subcontractors during the performance of this Contract, but not to the extent caused by others. The Contractor shall defend Owner on claims that do not present a conflict of legal theory or fact between Owner and Contractor. Each party shall defend itself on any claim that does present a conflict of legal theory or fact between the parties.
  - 3. Under no circumstances shall either party be liable for any loss, damage or delay due to any cause beyond either party's reasonable control, including but not limited to acts of government, fire, explosion, theft, weather damage, flood, earthquake, riot, civil commotion, war, mischief or act of God.
  - 4. In the event of a strike or work stoppage by Contractor's employees, the Contractor agrees to use its best efforts to fulfill its obligations pursuant to their contract utilizing management and supervisory personnel.
  - 5. Under no circumstances shall either party be liable to the other for special, indirect, or consequential damages of any kind including, but not limited to, loss of profits, loss of good will, loss of business opportunity, additional financing costs or loss of use of any equipment or property, whether in contract, tort (including negligence), warranty or otherwise, notwithstanding any indemnity or other provision to the contrary.

#### 1.3 SUBCONTRACTORS

- A. At the time of Bid the Subcontractor(s) (Bidder(s)) shall provide the names of the proposed Subcontractors on the Bid Form. Prior to the Awarding of the Contract, the Subcontractor shall submit to Hannig Construction Inc., in writing, the names of all the proposed Subcontractors and major material vendors. All Subcontractors shall be licensed and bonded and shall be held to the same level of experience and qualifications as are required of the Prime Contractor (Bidder).
- B. The Subcontractor shall be responsible for the acts and omissions of his Subcontractors and of persons either directly or indirectly employed by them as he is for the acts and omissions of persons directly employed by him.
- C. Nothing contained in the Contract shall create any contractual relationship between any Subcontractor and the Owner, and no Subcontractor will be recognized as a party to the Contract.
- D. The Sub-Contractor shall use the Subcontractors, Suppliers, Materials and Equipment as listed in the Bid Form submitted at the time of Bid. There shall be no changes permitted to this list except as agreed to in writing by the Owner/Hannig Construction Inc.

#### 1.4 DRAWINGS

- A. The drawings referred to in these specifications show such plans and details as are regarded necessary by the Architect/Engineer and/or the Owner to properly illustrate the work required, to estimate the cost of the work, and to complete its construction.
- B. The Architect/Engineer and/or the Owner will from time to time furnish such additional detail and working drawings as may be deemed necessary to interpret and explain the Contract drawings and all such additional drawings shall be of equal force with those mentioned above and shall be considered as forming part of this Contract.
- C. The general character of the work shall be subject to minor modifications when detailed or full sized drawings for such work are prepared.
- D. All lettering on drawings is to be considered a part of the drawings.
- E. All drawings, specifications, etc., are the property of the Owner and shall be returned before the final award is issued, if so requested.
- 1.5 RELATIONSHIP AND PRIORITY OF DOCUMENTS
  - A. The documents comprising the Contract are complementary and what is called for by one shall be as binding as if called for by all. The intention of the Contract is to include all labor, materials, and equipment necessary for the proper execution of the work.
  - B. In the case of a discrepancy between the requirements of the Drawings and the Specifications or between Sections of the Specifications:
    - 1. The more stringent shall apply.
    - 2. In equal situations the Specifications or as directed by the Owner prevails.

#### 1.6 PERMITS

- A. The Subcontractor shall give all requisite notices to public officials, secure and pay for all associated permits, legal fees or charges, have the work inspected by all proper public authorities, pay all charges connected with such inspections and deliver the proper inspection certificates and all receipts for charges to the Owner.
- B. The Subcontractor shall give all notices and comply with all laws, ordinances, rules, regulations and orders of any public authority bearing on the performance of the work. If the Subcontractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify the Owner in writing, and any necessary change shall be accomplished by the appropriate modification. If the Subcontractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations and without such notice to the Architect, he shall assume full responsibility therefore and shall bear all cost attributable thereto.

#### 1.7 SAMPLES

- A. The Subcontractor shall submit in writing to the Owner for approval samples and shop or installation drawings of the materials he proposes to use, or such other related materials as owner otherwise requests.
- B. Each sample shall be labeled, bearing the name and quality of the material, the Subcontractor's name, the date and a description of the sample. A letter from the Subcontractor stating that the samples conform to the requirements of the drawings and specifications shall accompany all such samples. Transportation charges on all samples shall be prepaid.
- C. Samples and drawings shall be submitted in due time so as to permit proper consideration without delaying the Subcontractor's operation. Material shall not be ordered until approval is received from the Owner/Hannig Construction Inc., in writing. The use of any material will be permitted only so long as it remains equal to the approved sample.

#### 1.8 CONTRACTOR'S SUPERVISION

- A. The Subcontractor shall maintain on the Project site a competent Foreman/Supervisor at all times any work is being performed; either by the Subcontractor's workers or any of it's Subcontractor's workers.
- B. The Subcontractor's foreman/supervisor shall represent the Subcontractor during their absence and all directions given the superintendent shall be as binding as if given to the Subcontractor.

#### 1.9 LAYING OUT AND UTILITY LOCATES

- A. The Subcontractor shall thoroughly examine the drawings and specifications before commencing work and report to the Owner if any discrepancy, errors, or defect appears, but he shall not be held responsible for their existence.
- B. The Subcontractor shall lay out his own work.
- C. Prior to any cutting, drilling, trenching, excavating or other earthwork the Subcontractor shall determine the exact location of all utility lines and appurtenances that could be encountered which are not shown on the drawings as follows.
  - 1. A minimum of forty-eight (48) hours prior to commencing work the Subcontractor shall contact Indiana Locates for all public utility locates.
- D. Failure to contact for the appropriate locates shall make Subcontractor solely responsible for all costs incurred to repair all damaged utility lines or appurtenances.
- E. The Subcontractor shall hand excavate within three (3) feet, or as required by the Utility Company, on either side of a marked utility unless exact depth of the marked utility is known and the planned work will in no way be in close proximity with the utility line or appurtenance.

#### 1.10 MATERIAL AND LABOR

- A. Except as otherwise stipulated, the Subcontractor shall provide and pay for all materials, labor, tools and equipment necessary for the execution of the work.
- B. The Owner/Hannig Construction Inc. reserves the right to require the Subcontractor to discontinue the service of any workmen employed on the work whom he deems incompetent, negligent, or otherwise objectionable, and to suspend any portion of the work embraced in the Contract whenever, in his opinion, it would be inexpedient to start or continue such work.

#### 1.11 DEFECTIVE WORK AND MATERIALS

- A. Any materials and workmanship found to be defective, improperly placed, not in strict conformity with the drawings and specifications, or defaced or injured through action of fire or elements, through usage by the Subcontractor or his employees or from any other cause, shall be removed immediately from the premises and satisfactory materials or work substituted therefore without delay. This shall include making good the work of other Subcontractors destroyed or damaged by such removal or replacement. The cost of the above replacements shall be borne by the Subcontractor responsible for the defective work or material.
- B. Should the Subcontractor in the execution of his work discover any imperfections or errors in the work of other Subcontractors that would interfere with the proper execution of his contract, he shall immediately report this fact to the Owner. Errors or imperfections in the work of other Subcontractors will in no case excuse installation of imperfect work by this Contractor.
- C. No previous inspection shall be held as an acceptance of defective work or materials or relieve the Subcontractor from the obligation to furnish sound materials or to perform satisfactory work in accordance with the contract requirements. The final payment shall not relieve the Subcontractor of the responsibility for faulty materials or workmanship and he shall remedy all such defects, settlements, or other work resulting there from, which shall appear within a period of one (1) year from date of final acceptance or within the period stipulated in certain separate guarantees or bonds required elsewhere in the specifications, whichever may be the longer.
- D. Hannig Construction Inc. shall be the sole judge of the materials furnished and the character of work performed.

#### 1.12 RESPONSIBILITY FOR DAMAGE

- A. The Subcontractor shall be responsible for all damages to life and property due to his action or failure to act when action would reasonably be expected. He shall be responsible for all parts of his work, both temporary and permanent, until the work under his contract is declared accepted by the Owner.
- B. The Subcontractor shall continuously maintain adequate protection of all his work from damage, and shall protect the Owner's property and all adjacent property from injury in connection with the Contract.

- C. The Subcontractor shall be held responsible for damage to work of other Subcontractors that is the result of his operation.
- D. Should the Subcontractor believe that the work shown by the drawings or specifications is not correct when executed to obtain safe and substantial results, or if any discrepancy appears, it is his duty to immediately notify the Owner in writing, stop work on same, and await written instruction.

#### 1.13 CLEANING UP

- A. The Subcontractor shall at all times keep the premises free from accumulations of waste material or rubbish.
- B. When directed by Hannig Construction Inc., the Contractor shall clear out and remove any rubbish that may constitute an obstruction to the progress of the work.
- C. When directed by Hannig Construction Inc., the Contractor shall clear obstructions referenced above and clean the project site or vicinity of the project in which the quality of work being performed or scheduled to be performed could be affected by conditions present.
- D. The Subcontractor shall clear excessive mud, rocks, and soils from nearby drives/roads that accumulate from vehicular traffic in and out of the project site and other operations at or near the street.
- E. At completion of the contract, the Subcontractor shall remove from the premises all of their rubbish and surplus material, and shall repair any damage to his work no matter by who caused, and shall leave the premises clean and in perfect repair and order.

#### 1.14 NON-DISCRIMINATION CLAUSE

A. "Pursuant to the requirements of Indiana Code 22-9-1-10 and 5-16-6-1, Subcontractor and his Subcontractors may not discriminate against any employee or applicant for employment to be employed in the performance of such contract, with respect to their hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment because of their sex, race, natural origin, ancestry or religion or disability as prohibited under the Americans With Disabilities Act. The subcontractor and subcontractor, if any, agrees to comply with all the provisions contained in the Equal Opportunity Clause quoted in Executive Orders No. 11246 and No. 11375. In addition, the contractor shall cause this Equal Opportunity Clause to be included in the subcontracts or purchase orders hereunder unless exempted by rules, regulations and orders of the Secretary of Labor issued pursuant to Section 204 of the Executive Orders No. 11246 and No. 11375 as amended. Breach of the covenant may be regarded as a material breach of contract."

#### 1.15 PUBLIC RELATIONS

A. Any inappropriate actions toward any of the Owner's employees, staff, or persons employed by the Owner to facilitate the completion of the project by any Subcontractor's Employee shall

result in the employee being told to leave the project immediately. This employee shall not be allowed to return to work on the Project for the duration of the Project.

#### 1.16 "OR APPROVED EQUAL" CLAUSE

- A. Unless the Specifications indicates that substitutions are not allowed, whenever a material or article required is specified or shown on the plans by using the name of the proprietary product or of a particular manufacturer or vendor, any material or article which will perform adequately the duties imposed by the general design will be considered equal and satisfactory providing the material or article so proposed is of equal substance and function in the Architect/Engineer and Owner's opinion. It shall not be purchased or installed without written approval.
- B. Complete descriptive information, specifications and samples or sample material must be submitted at the time the proposal is submitted. In addition, a list of projects with dates and contact persons must be submitted at the time the proposal is submitted showing where the proposed alternate material or article has been installed or used. Failure to submit information as requested will be cause for rejection of the Bid submitted.

#### 1.17 VERIFYING MEASUREMENTS

A. The Subcontractor shall verify all measurements on the site and be responsible for any mistakes he may make and their results. If the Subcontractor discovers any discrepancy, in figures on the drawings, he shall report same to the Architect/Engineer and Hannig Construction Inc. before proceeding with any work affected by the discrepancy and shall be held responsible for results should he fail to make such reports.

#### 1.18 EXTRAS

- A. Without invalidating the Contract, the Owner may order extra work or make changes by altering, adding to, or deducting from the work, the Contract sum being adjusted accordingly, and the consent of the Surety being first obtained where necessary or desirable. All work of the kind Bid upon shall be paid for at the price stipulated in the proposal, and no claims for any extra work or materials shall be allowed unless the work is ordered in writing by the Owner, and the price is stated in such order.
- B. Requests for compensation, for previously approved Change Orders omitted from an Application for Payment, received sixty (60) calendar days after Owner receipt of the Final Application for Payment (Release of Retainage) shall not be honored.

#### 1.19 GENERAL GUARANTY

A. Neither the final certificate of payment nor any provision in the Contract documents nor partial or entire occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with the Contract documents or relieve the Subcontractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Subcontractor shall remedy any defects in the work and pay for any

damage to other work resulting there from, which shall appear within a period of one (1) year from the date of final acceptance of the work, unless a longer period is specified.

#### 1.20 SPECIAL COVID-19 GUIDELINES

- A. Any time a Contractor, Subcontractor, any of their employees or their representatives, any Suppliers or their representatives, or any Delivery Persons are on the Teamster's Jobsite, Owner's premises, or in attendance at a project meeting (regardless of location), they shall comply with the State of Indiana rules and guidelines regarding COVID-19 as well as rules established by Hannig Construction, Inc.
- PART 2 PRODUCTS (Not Used)
- PART 3 EXECUTION
- 3.1 HANNIG CONSTRUCTION, INC. COVID-19
  - A. Following this section is Hannig Construction's "COVID-19 Trade partner Jobsite Protection, Preparedness, Response and Back-to-Work Plan (Rev 06.01.2020)" which is to be followed as described in section 1.20 above.

END OF DOCUMENT 00 20 20

#### DOCUMENT 00 21 13 - INSTRUCTIONS TO BIDDERS

#### 1.1 INSTRUCTIONS TO BIDDERS

- A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.
  - 1. A copy of AIA Document A701, "Instructions to Bidders," is bound in this Project Manual.

END OF DOCUMENT 00 21 13

#### DOCUMENT 00 25 13 - PREBID MEETINGS

- 1.1 PREBID MEETING
  - A. Architect and Owner will conduct a Prebid meeting as indicated below:
    - 1. Meeting Date: Wednesday, January 5, 2022.
    - 2. Meeting Time: 2:00 PM, local time.
    - 3. Location: Laborer's International Union Local #120, 1520 E. Riverside Dr., Indianapolis, IN 46202.
    - 4. A jobsite visit will be available following the Prebid meeting at the project site, 5440 Lafayette Rd, Indianapolis, IN 46254.
  - B. Attendance:
    - 1. Attendance at the Prebid is not mandatory.
  - C. Bidder Questions: Submit written questions to be addressed at Prebid meeting minimum of two business days prior to meeting.
  - D. Agenda: Prebid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:
    - 1. Procurement and Contracting Requirements:
      - a. Instructions to Bidders.
      - b. Insurance.
      - c. Bid Form and Attachments.
      - d. Bid Submittal Requirements.
    - 2. Communication during Bidding Period:
      - a. Obtaining documents.
      - b. Access to Project Web site.
      - c. Bidder's Requests for Information.
      - d. Bidder's Substitution Request/Prior Approval Request.
      - e. Addenda.
    - 3. Contracting Requirements:
      - a. Agreement.
      - b. The General Conditions.
      - c. The Supplementary Conditions.
      - d. Other Owner requirements.
    - 4. Construction Documents:
      - a. Scopes of Work.
      - b. Temporary Facilities.
      - c. Use of Site.
      - d. Work Restrictions.
      - e. Alternates, Allowances, and Unit Prices.
      - f. Substitutions following award.
    - 5. Separate Contracts:
      - a. Work by Owner.
      - b. Work of Other Contracts.

- 6. Schedule:
  - a. Project Schedule.
  - b. Contract Time.
  - c. Other Bidder Questions.
- 7. Post-Meeting Addendum.
- E. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes to attendees. Minutes of meeting are issued as Available Information and do not constitute a modification to the Procurement and Contracting Documents. Modifications to the Procurement and Contracting Documents are issued by written Addendum only.
  - 1. Sign-in Sheet: Minutes will include list of meeting attendees.

END OF DOCUMENT 00 25 13

#### DOCUMENT 00 31 32 - GEOTECHNICAL DATA

#### 1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.
- B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.
- C. Soil-boring data for Project, obtained by Alt & Witzig , dated <**Insert date of logs**>, is available for viewing as appended to this Document.
- D. A geotechnical investigation report for Project, prepared by <**Insert agency or firm name**> , dated <**Insert date of report**>, is available for viewing as appended to this Document.
  - 1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
  - 2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.
- E. Related Requirements:
  - 1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.

END OF DOCUMENT 00 31 32

# SUBSURFACE INVESTIGATION & FOUNDATION RECOMMENDATIONS

LIUNA LOCAL 120 INDIANAPOLIS, INDIANA A&W PROJECT NO.: 211N0829

PREPARED FOR: Lynch, Harrison, & Brumleve, Inc. Indianapolis, Indiana

PREPARED BY: ALT & WITZIG ENGINEERING, INC. GEOTECHNICAL DIVISION

**DECEMBER 21, 2021** 



December 21, 2021

Lynch, Harrison, & Brumleve, Inc. 550 Virginia Avenue Indianapolis, Indiana 46203 Attn: Mr. Scott Clore

## **Report of Subsurface Investigation and Geotechnical Recommendations**

RE: LIUNA Local 120 5440 Lafayette Road Indianapolis, Indiana Alt & Witzig File: 21IN0829

Dear Mr. Clore:

In compliance with your request, we have conducted a subsurface investigation and geotechnical evaluation for the above referenced project. It is our pleasure to transmit an electronic copy of the report.

The purpose of this subsurface investigation was to determine the various soil profile components, the engineering characteristics of the subsurface materials, and to provide information for use in determining an economical, structurally sound foundation system for the new facilities. A detailed discussion of our subsurface investigation results and recommendations are presented herein.

We appreciated the opportunity to work with you on this project. Often, because of design and construction details that occur on a project, questions arise concerning the soil conditions. If we can give further service in these matters, please contact us at your convenience.



Sincerely, Alt & Witzig Engineering, Inc.

David M. Shumate, Engineering Geologist

Thomas J. Coffey, P.E.

Subsurface Investigation and Foundation Engineering Construction Materials Testing and Inspection Environmental Services



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## APPENDIX A

Recommended Specifications for Compacted Fills and Backfills Undercut Detail for Footing Excavation in Unstable Materials Boring Logs General Notes

#### APPENDIX **B**

Seismic Design Parameters Custom Soil Resource Report for Marion County, Indiana



## INTRODUCTION

This report presents the results of a subsurface investigation performed for the proposed LIUNA Local 120 to be constructed in Indianapolis, Indiana. Our investigation was conducted for Lynch, Harrison, & Brumleve, Inc. of Indianapolis, Indiana. Authorization to perform this investigation was in the form of a proposal prepared by Alt & Witzig, Engineering, Inc. (Alt & Witzig Proposal: *2110G058*) and was accepted by Scott Clore.

The scope of this investigation included a review of geological maps of the area and a review of geologic and related literature; a reconnaissance of the immediate site; a subsurface exploration; field and laboratory testing; and engineering analysis and evaluation of the materials.

The purpose of this subsurface investigation was to determine the various soils profile components, the engineering characteristics of the subsurface materials, and to provide criteria for use in assessing the site for construction and evaluating subsurface conditions.

The scope or purpose of this investigation did not either specifically or by implication provide an environmental assessment of the site.



## **DESCRIPTION OF SITE**

The site is located at 5440 Lafayette Road, on the east side of Interstate 65 and approximately two hundred (200) feet south of Monica Drive in Indianapolis, Indiana. The general vicinity of the site is shown in an aerial photograph taken in 2020 provided in *Exhibit 1* below.



Exhibit 1 – 2020 Aerial Photograph of Site; Google Earth

## Site Description

The site is currently occupied by a single-family residence and a detached garage. The site is gently sloping down from northwest to southeast with an estimated relief of five (5) feet across the site. The approximate elevation of the site ranges between 806 feet to 811 feet, per Google Earth. Ground cover across the site during drilling operations consisted of grass. The surrounding areas are developed with residential and commercial structures, paved roadways, and underground/overhead utilities. Drainage of the site towards the storm water ditch along Lafayette Road.



## FIELD INVESTIGATION

## **Boring Locations**

Alt & Witzig Engineering, Inc. staked the locations of the borings using the site plan provided with the RFP. The site plan was projected onto aerials provided by the Google Earth website allowing for the correlation of the approximate latitude and longitude coordinates with each location. These coordinates were then assigned as waypoints and uploaded into a handheld GPS unit. The locations referred to on our boring logs and presented on the Boring Location Plan below (*Exhibit 2*).

## Exhibit 2 – Boring Locations



## **General**

Field investigations to determine the engineering characteristics of the subsurface materials included a reconnaissance of the project site and performing twelve (12) borings and one (1) infiltration test located approximately as shown in the *Exhibit 2*, performing standard penetration tests, and obtaining soil samples retained in the standard spilt-spoon sampler for further laboratory testing. The apparent groundwater level at each boring location was also determined.



## **Drilling and Sampling Procedures**

The soil borings were drilled using a track-mounted drilling rig equipped with a rotary head. Hollowstem augers were used to advance the holes. The advancement of the borings was temporarily stopped at regular intervals to perform standard penetration tests in accordance with ASTM Procedure D-1586 to obtain the standard penetration value of the soil.

The standard penetration test involves driving a split spoon soil sampler into the ground by dropping a 140-pound hammer, thirty (30) inches. The number of hammer drops required to advance the split-spoon sampler one (1) foot into the soil is defined as the standard penetration value. The soil samples retained in the split-spoon sampling device as a result of the penetration tests were obtained, classified, and labeled for further laboratory investigation.

## Water Level Measurements

The apparent groundwater level at each boring location was measured during and upon completion of the drilling operations.

These water level measurements consisted of observing the depth at which water was encountered on the drilling rods during the soil sampling procedure and measuring the depth to the top of any water following removal of the hollow stem augers. It should be noted that the groundwater level measurements recorded on the individual *Boring Logs* in Appendix A of this report are accurate only for the specific dates on which the measurements were performed. It must be understood that the groundwater levels will fluctuate throughout the year and the *Boring Logs* do not indicate these fluctuations.

## **Ground Surface Elevation**

Ground surface elevations were not available at the time of this report. All depths reported on the *Boring Logs* are from the existing ground surface at the time of the drilling operations.



## LABORATORY INVESTIGATION

In addition to field investigations, a supplemental laboratory investigation was conducted to ascertain additional pertinent engineering characteristics of the subsurface materials. The laboratory-testing program included:

- Classification of soils with ASTM D-2488
- Moisture content tests with ASTM D-2216
- Samples of the cohesive soil were frequently tested in unconfined compression by use of a calibrated spring testing machine.
- A soil Penetrometer was used as an aid in determining the strength of the soil.

The values of the unconfined compressive strength as determined on soil samples from the split-spoon sampling must be considered, recognizing the manner in which they were obtained since the split-spoon sampling techniques provide a representative but somewhat disturbed soil sample.



#### SUBSURFACE CONDITIONS

### **General**

The types of foundation materials encountered have been visually classified and are described in detail on the *Boring Logs*. The results of the field penetration tests, strength tests, water level observations and laboratory water contents are presented on the *Boring Logs* in numerical form. Representative samples of the soils encountered in the field were placed in sample jars and are now stored in our laboratory for further analysis if desired. Unless notified to the contrary, all samples will be disposed of after two (2) months.

#### **Soil Conditions**

Borings B-1 through B-4, which were performed in the footprint of the proposed structure, encountered approximately four (4) to six (6) inches of topsoil at the ground surface. Beneath the topsoil, the borings encountered soft to medium stiff cohesive soils extending to a depth of fifteen (15) feet. At this depth the soils increase to a stiff to hard consistency extending to the termination depth of the borings. Moisture contents of the shallow soils ranged between 10 to 22 percent.

Borings S-1 through S-7, which were performed in the proposed paved parking and drives with the exception of S-4, encountered four (4) to five (5) inches of topsoil underlain by soft to stiff cohesive soils that increase in consistency with depth extending to the boring termination depths. Moisture contents of the shallow soils ranged between 10 to 22 percent.

Borings S-4 and P-1, which were performed in the proposed dry detention area, encountered four (4) to five (5) inches of topsoil underlain by soft to stiff cohesive soils that increase in consistency with depth extending to the boring termination depths. Moisture contents of the shallow soils ranged between 11 to 25 percent.

Detailed soil descriptions at each boring location have been included on the *Boring Logs* in Appendix A of this report.

According to the *Soil Survey of Marion County, Indiana* published by the United States Department of Agriculture Soil Conservation Service, the majority of the soil covering this site is

classified as Urban Land-Brookston Complex (UbaA), Brookston Silty Clay Loam-Urban Land Complex (YbvA), Crosby Silt Loam (YclA), and Miami Silt Loam-Urban Land Complex (YmsB2) type soils. The *Custom Soil Resource Report for Marion County, Indiana* has been included in Appendix B.

## **Bedrock Geology**

Geologic maps published by the Indiana Geological Survey indicate the bedrock at this site consists of New Albany Shale, which is characterized by shale of the Devonian age. The approximate elevation of this bedrock ranges between 650 and 700 feet, which is greater than 100 feet below the existing ground surface.

## Seismic Consideration

Based on the field and laboratory tests performed on the subsurface materials and an assumption that the bedrock surface is greater than 100 feet below the existing ground surface, this site should be considered a Site Class C in accordance with the 2015 Indiana Building Code.

Maximum spectral response acceleration values of Ss=0.158 g and  $S_1=0.085$  g are recommended for seismic design.

## **Groundwater**

Groundwater levels taken during and upon completion of the boring operations yielded measurements as shallow as six (6) feet. The exact location of the water table may fluctuate somewhat depending upon normal seasonal variations in precipitation and surface runoff.

The *Soil Survey of Marion County, Indiana* indicates a seasonal high groundwater table as shallow as the natural ground surface. Again, it should be noted that the groundwater level measurements recorded on the individual *Boring Logs* included in Appendix B of this report, are accurate <u>only</u> for the dates on which the measurements were performed.



## **Infiltration Discussion**

The infiltration test was conducted on December 2<sup>nd</sup>, 2021. A falling-head percolation rate was measured by introducing water into the PVC and allowed to fall while taking readings at specific time intervals. This was conducted numerous times in the borehole and the data reviewed for trends and determination of infiltration rate.

The geometry of the borehole and water head was utilized to determine the average permeability rate of the soil profile. The soil at the infiltration zone was a hard, sandy clay. Infiltration test conducted on differing subsurface layers will produce results that vary from the results indicated herein.

The percolation and infiltration rates as determined through the one (1) borehole permeameter test conducted at this site can be found in the following Table 1.

Location	Infiltration Depth (ft.)	Field Measured Percolation Rate (min/in)	Calculated Infiltration Rate (in/hr)
P-1	9.0-10.0	2,304	0.03

 Table 1: Percolation Test Results



#### **GEOTECHNICAL ANALYSIS & RECOMMENDATIONS**

## **Project Description**

Provided plans indicate the proposed building will be constructed as a slab-on-grade structure, along with associated paved parking and driving lanes surrounding the structure and a dry detention area located to the east.

Site plans provided by the client indicate a final floor elevation of 810.50' for the proposed structure. Based on the existing topography of the site, approximately (1) foot of relief exists over the proposed building footprint. Finished grade will be established slightly above the existing ground surface.

Structural loads were not available at the time of this report; however, it was assumed for analysis purposes that the structure will be constructed with maximum column and wall loads not exceeding 75 kips and 4 klf, respectively. It is expected that these structural loads will be transferred to the soils by conventional spread footings or continuous wall footings, if possible. Once final design loads are available, they should be submitted to Alt & Witzig Engineering, Inc. for review. After a review of this information, it will be determined if changes to these recommendations are warranted.

## **Foundation Recommendations**

Considering the encountered soil conditions at the boring locations, the estimated loads of the structure, and the relative economics of the available foundation types, conventional spread and continuous wall footings founded at a shallow depth appear to represent a feasible foundation solution for this project.

A net allowable bearing pressure of **2,000 psf** is recommended for dimensioning spread footings and continuous wall footings, provided they are founded on medium stiff, native soils.

It is recommended that a representative of Alt & Witzig Engineering, Inc. inspect all foundation excavations prior to the placement of concrete. At the time of this inspection, Housel penetrometer or other approved tests may be performed to confirm that unanticipated soil materials or debris are not present.
The above recommended bearing pressures will help reduce differential settlements associated with footings founded on soil with varying stiffness across the building pad. Using the above-mentioned bearing pressure and recommendations for limiting settlements, total settlements of less than one (1) inch and differential settlements of one half ( $\frac{1}{2}$ ) inch or less can be anticipated. In utilizing the above-mentioned net allowable pressures for dimensioning footings, it is necessary to consider only those loads applied above the finished floor elevation.

To alleviate the effects of seasonal variation in moisture content on the behavior of the footings and eliminate the effects of frost action, all exterior foundations should be founded a minimum of three (3) feet below the final grade.

Some modifications to the recommendations provided in this report may be necessary based on potential complications or modifications to the design plan. Some shallow fills not evident in our sampling may be present that can affect the suitability of the subgrade and foundation soil. The modifications may influence the overall cost of the project and construction sequence. If complications become apparent to the design team or owner, this information should be provided to Alt & Witzig Engineering, Inc. as soon as possible.

### Floor Slab Recommendations

Prior to elevating the site, the existing subgrade soils must be proofrolled with approved equipment. Areas that pass the proofroll inspection may be raised to design subgrade elevation as outlined in Appendix A of this report. It is recommended that a representative of Alt & Witzig Engineering, Inc. be present to determine remediation, dictated by the field conditions during construction. Areas of shallow unstable materials should be anticipated due to elevated moisture contents within the shallow soils, such as in borings B-2 and B-4. The exact stabilization method used will be dependent upon the size of the area and the types of materials encountered, as well as the project schedule. If weather conditions are favorable, the soils may be aerated, dried, and recompacted. However, if weather conditions or construction schedule dictate immediate improvement then chemical modification may be necessary.

After the building area has been raised to the proper elevation, a free-draining granular fill should be placed immediately beneath all floor slabs. It is recommended that the materials within the floor slab

subgrade area be compacted to a minimum density of 93 percent of maximum density in accordance with ASTM D-1557.

### **Pavement Recommendations**

The strength of the subgrade soils at this site depends upon several variables including compaction and drainage. It is, therefore, extremely important that all paved areas be designed to prevent water from collecting or ponding immediately beneath the pavement. This can be accomplished by sheet draining the parking area and sloping the subgrade soils and outletting them to a drain or a ditch to allow for subgrade drainage, or by the installation of a subsurface drainage system. It is recommended that underdrains be installed at the transitions from concrete to asphalt as well.

For these soils to provide adequate support for pavement, it will also be necessary that the earthmoving contractor follow proper site work techniques. The exposed subgrade should be proof-rolled with equipment approved by a representative of Alt & Witzig Engineering, Inc. This proof-rolling will assist in identifying pockets of soft unstable materials beneath exposed subgrades. As mentioned before, some of the shallow soils encountered elevated moisture contents, such as in borings S-3 and S-7. Where soft areas or unstable fill materials are encountered, remediation will be dictated by the field conditions experienced during construction.

In areas where fill will be required to raise the site to proposed grade, the performance of the pavements will be greatly affected by the quality of compaction achieved in the subgrade soils. Thus, it is recommended that all pavement areas be compacted to 93 percent of the material's maximum dry density as determined by ASTM D-1557.



#### **CONSTRUCTION CONSIDERATIONS**

#### Site Preparation

Excessively organic topsoil and loose dumped fill materials will generally undergo high volume changes that are detrimental to the behavior of pavements, floor slabs, structural fills, and foundations placed upon them. It is recommended that all topsoil and/or loose materials be stripped from the construction areas and wasted or stockpiled for later use.

The depth and consistency of these materials will vary across the site. It should be noted that the soil borings only indicate the apparent topsoil section thickness at their specific locations. Borings do not indicate variations in the thickness of this layer between selected locations. Thus, borings only provide a general indication of the amount of stripping.

The condition of the subgrade at the time of earthmoving operations and the methods used by the contractor will influence the depth of stripping. A representative of Alt & Witzig Engineering, Inc. in the field should determine the exact depth of stripping and undercutting at the time of stripping operations.

It is recommended that after the above-mentioned stripping procedures have been performed, the exposed subgrade should be proofrolled with approved equipment. This proofrolling will determine where areas of soft unsuitable materials are encountered. Due to the elevated moisture contents encountered in some of the shallow soils, such as in borings B-2, B-4, S-3, and S-7, some subgrade soils may not favorably pass a proofroll inspection. It is recommended that a representative of Alt & Witzig Engineering, Inc. be present for this phase of this project.

After the existing subgrade soils are excavated to design grade, proper control of subgrade compaction and fill, and structural fill replacement should be maintained in accordance with the *Recommended Specifications for Compacted Fills and Backfills*, presented in Appendix A of this report; thus minimizing volume changes and differential settlements which are detrimental to behavior of shallow foundations, floor slabs and pavements.



### **Groundwater**

Groundwater levels taken during and upon completion of the boring operations yielded measurements as shallow as six (6) feet. The exact location of the water table may fluctuate somewhat depending upon normal seasonal variations in precipitation and surface runoff.

The *Soil Survey of Marion County, Indiana* indicates a seasonal high groundwater table as shallow as the natural ground surface. Again, it should be noted that the groundwater level measurements recorded on the individual *Boring Logs* included in Appendix B of this report, are accurate <u>only</u> for the dates on which the measurements were performed.

Depending upon the time of the year and the weather conditions when the excavations are made, seepage from surface runoff may occur into shallow excavations or soften the subgrade soils. Since these foundation materials tend to loosen when exposed to free water, every effort should be made to keep the excavations dry should water be encountered. Sump pumps or other conventional dewatering procedures should be sufficient for this purpose within the cohesive soil. Significant dewatering should be expected if excavations penetrate the underlying wet sands. It is also recommended that all concrete for footings be poured the same day as the excavation is made.



### STATEMENT OF LIMITATIONS

This report is solely for the use of Lynch, Harrison, & Brumleve, Inc. and any reliance of this report by third parties shall be at such party's sole risk and may not contain sufficient information for purposes of other parties for other uses. This report shall only be presented in full and may not be used to support any other objectives than those set out in the scope of work, except where written approval and consent are provided by Lynch, Harrison, & Brumleve, Inc. and Alt & Witzig Engineering, Inc.

An inherent limitation of any geotechnical engineering study is that conclusions must be drawn based on data collected at a limited number of discrete locations. The geotechnical parameters provided in this report were developed from the information obtained from the test borings that depict subsurface conditions only at these specific locations and on the date indicated on the boring logs. Soil conditions at other locations may differ from conditions encountered at these boring locations and groundwater levels shall be expected to vary with time. The nature and extent of variations between the borings may not become evident until the course of construction.

The exploration and analysis reported herein is considered in sufficient detail and scope to form a reasonable basis for design. The recommendations submitted are based on the available soil information and assumed design details enumerated in this report. If actual design details differ from those specified in this report, this information should be brought to the attention of Alt & Witzig Engineering, Inc. so that it may be determined if changes in the foundation recommendations are required.

## APPENDIX A

Recommended Specifications for Compacted Fills and Backfills Undercut Detail for Footing Excavation in Unstable Materials Boring Logs General Notes

### **RECOMMENDED SPECIFICATIONS FOR COMPACTED FILLS AND BACKFILLS**

All fill shall be formed from material free of vegetable matter, rubbish, large rock, and other deleterious material. Prior to placement of fill, a sample of the proposed fill material should be submitted to Alt & Witzig Engineering, Inc. for approval. The surface of each layer will be approximately horizontal but will be provided with sufficient longitudinal and transverse slope to provide for runoff of surface water from every point. The fill material should be placed in layers not to exceed eight (8) inches in loose thickness and should be sprinkled with water as required to secure specified compactions. Each layer should be uniformly compacted by means of suitable equipment of the type required by the materials composing the fill. Under no circumstances should a bulldozer or similar tracked vehicles be used as compacting equipment. Material containing an excess of water, so the specified compaction limits cannot be attained should be spread and dried to a moisture content that will permit proper compaction. All fill should be compacted to the specified percent of the maximum density obtained in accordance with ASTM density Test D-1557 (95 percent of maximum dry density below the base of footing elevation, 93 percent of maximum dry density beneath floor slabs and pavements). Should the results of the in-place density tests indicate that the specified compaction limits are not obtained; the areas represented by such tests should be reworked and retested as required until the specified limits are reached.





CLIENT <b>Lynch, Harrison &amp; Brumleve, Inc.</b>	BORING #	B-01
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE <u>#</u>	21IN0829
PROJECT LOCATION Indianapolis, IN		

	DRILLING and S	AMPLING INFORMATION												
Date Started	11/21/21	Hammer Wt.	140	lbs										
Date Completed	11/21/21	Hammer Drop	30	in.							тс	97 DA	гл	
Boring Method	HSA	Spoon Sampler OD	2	_in.		[								
Driller <u><b>D. McV</b></u>	Vherter	Rig Type CME 55	ATV	_						5	gth	e	(fc	
[]							эе	raphics Braphics	ater	enetratio ows/foot	onfined ve Stren	letromet	ontent % eight (po	
STRATA	SOIL CLA	SSIFICATION		ء	- a	ple	ple Tyl	pler G	Ind Wa	dard P N - bl	sf Unco pressiv	sf tet Per	ture Co Unit W	arks
ELEV.	SURFACE	ELEVATION	Strat	Dept	Dept	Sam No.	Sam	Sam Recc	Grou	Stan Test,	Qu-ts Com	PP-ts Pock	Moist Dry	Rem
	-	TOPSOIL	_/ (	0.5	-									
					- 	1	SS	X		5	1.2	0.5	16.7	
					- - 5 —	2	SS	X		9	1.9	3.5	10.5	
	Brown S	ilty Sandy CLAY			- - - -	3	SS	X	¥	6	0.4	0.5	15.1	
					- - 10 — -	4	SS	X		7	1.2	2.0	13.6	
			1!	5.0	- - - - - - - - - - - - - -	5	SS	V		35	3.9	4.5	5.7	
					-			Å	R					
	Gray Silty Sandy	CLAY with Sand Seams		1.0	20 —	6	SS	X	0	29	2.5	4.5	11.0	
	End of E	Boring at 21 feet	2	1.0	-									
Sample Typ SS - Driven Split Spr ST - Pressed Shelby CA - Continuous Flig RC - Rock Core CU - Cuttings CT - Continuous Tut	e oon y Tube ht Auger	〇 Du 又 At 超 C ▼ Af	 uring Dr Compl aved A ter _ <u>4.0</u>	Grou rilling etion t Co <u>)</u> hou	Indwat 	er1 on1 0 ft	19.0 ft Dry ft 7.0 ft.			H C D M	SA - H  FA - C  C - D  D - M	Boring ollow S ontinuc riving C lud Drill	Metho Item Au Dus Fligi Casing ling	d gers ht Augers



CLIENT	BORING #	B-02
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE <u>#</u>	21IN0829
PROJECT LOCATION Indianapolis, IN		

		DRILLING and \$	SAMPLING INFORMATIC	ON											
Date Sta	rted	11/21/21	_ Hammer Wt	140	_lbs										
Date Cor	npleted	11/21/21	_ Hammer Drop	30	_in.							TF	ST DA	ГА	
Boring M	ethod	HSA	_ Spoon Sampler OD	2	_in.										
Driller	D. McV	Vherter	Rig Type CME	55 ATV	-						Б.,	gth	Ŀ	cf)	
							1	ЭС	aphics Sraphics	iter	enetrati ows/foot	onfined /e Stren	etromet	ontent % eight (pu	
STRATA		SOIL CLA	ASSIFICATION		_	<b>5 a</b>	ole	ole Typ	very G	aW br	lard P N - bl	f Unco	f et Pen	ure Co Init W	arks
ELEV.		SURFAC	E ELEVATION	Strata	Depth	Depth Scale	Samp No.	Samp	Samp Reco	Groui	Stanc Test,	Qu-ts Comp	PP-ts Pock	Moisti Dry L	Rem
_			TOPSOIL		0.3	-	-								
-						-	1	SS	V		5	1.2	0.5	20.2	
-		Brown and G	ray Sandy Silty CLAY			-	-		$\square$						
					5.0	5 -	2	SS	X		12	0.4	1.5	12.3	
						-	3	SS	X	Ţ	9	0.8	1.0	10.8	
		Brown S	Silty Sandy CLAY			- - 10 -	4	SS	X		9	0.4	0.5	12.6	
				1!	5.0						20	4.0	4.5	7.0	
						15 — - - -	. 5	55	X	Mai (	20	1.2	4.5	1.2	
		Gray Silty Sand	/ CLAY with Sand Seams	s 2.	1 0	20 -	6	SS	X	0	30	2.5	4.0	8.0	
	<u></u>	End of	Boring at 21 feet			-									
SS - Driven ST - Presse CA - Contine RC - Rock C CU - Cutting CT - Contine	nple Typ Split Sp d Shelby uous Flig Core gs uous Tul	e con / Tube ht Auger pe	⊂ Z	 During Dr At Compl Caved A After _2.0	Grou rilling etior t Co <u>)</u> hou	ndwat g n mpleti urs <u>8.</u>	on <u>1</u>	18.0 ft Dry ft 6.5 ft.	<u>t.</u> <u>t.</u>		H C D N	SA - H  FA - C  C - D  D - M	Boring Iollow S Continuc Priving C Iud Drill	<u>Metho</u> item Au bus Fligi Casing ling Pa	d gers nt Augers age <b>1</b> of <b>1</b>



CLIENT Lynch, Harrison & Brumleve, Inc.	BORING #	B-03
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE #	21IN0829
PROJECT LOCATION Indianapolis, IN	_	





CLIENT <b>Lynch, Harrison &amp; Brumleve, Inc.</b>	BORING #	B-04
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE <u>#</u>	21IN0829
PROJECT LOCATION Indianapolis, IN		





CLIENT <b>Lynch, Harrison &amp; Brumleve, Inc.</b>	BORING #	P-01
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE <u>#</u>	21IN0829
PROJECT LOCATION Indianapolis, IN		





CLIENT <b>Lynch, Harrison &amp; Brumleve, Inc.</b>	BORING #	S-01
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE <u>#</u>	21IN0829
PROJECT LOCATION Indianapolis, IN		





CLIENT Lynch, Harrison & Brumleve, Inc.	BORING #	S-02
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE <u>#</u>	21IN0829
PROJECT LOCATION Indianapolis, IN		





CLIENT Lynch, Harrison & Brumleve, Inc.	BORING #	S-03
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE #	21IN0829
PROJECT LOCATION Indianapolis, IN	_	





CLIENT	BORING #	S-04
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE <u>#</u>	21IN0829
PROJECT LOCATION Indianapolis, IN		





CLIENT <b>Lynch, Harrison &amp; Brumleve, Inc.</b>	BORING #	S-05
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE <u>#</u>	21IN0829
PROJECT LOCATION Indianapolis, IN		

		DRILLING	G and SAMPLING INFORMA	TION											
Date Sta	rted	11/21/21	Hammer Wt.	140	_lbs										
Date Completed 11/21/21		Hammer Drop	Drop <b>30</b> _in.				TEST ΠΑΤΑ								
Boring Method HSA Spoor			Spoon Sampler C	DD <u>2</u>	_in.		1								
Driller Rig Type Rig Type C				ME 55 ATV	_						t t	ngth	ter	6 Cf)	
	1							be	raphics Sraphic	ater	enetrat ows/foo	onfined ve Strer	letrome	ontent % eight (p	
STRATA	TRATA SOIL CLASSIFICATION					<b>ب</b>	ple	ole Tyl	pler G	nd Wa	dard F N - bl	sf Unc pressi	sf tet Per	ture Co Unit M	arks
ELEV.		SU	RFACE ELEVATION	Strat	Dept	Dept	Sam No.	Sam	Sam Reco	Grou	Stan Test	Qu-t Com	PP-ts Pock	Moist Dry	Rem
			TOPSOIL	ſ	0.3	-									
-						-	-								
		Brown	and Gray Sandy Silty CLAY			-	1	SS	X		7	0.4	1.0	16.0	
-						-			Ĥ						
					5.0	- 5 —	2	SS	$\overline{\mathbf{V}}$		6		3.0	14.2	
-						-			Д						
_						-	3	SS			6	0.8	15	13.7	
	Brown Silty Sandy CLAY					-			Å		Ū	0.0			
-						-	-								
				1	10	10 —	4	SS	X		9	2.3	3.0	11.9	
-		E	End of Boring at 11 feet		1.0	-									
	 				0								Deriv	Matte	
_ <u>Sar</u> SS - Driven	nple Typ Split Sp	e oon		During D	<u>Grou</u> rilline	indwat 9	er	Dry ft	t.		н	SA - H	Boring ollow S	tem Au	a Igers
ST - Presse CA - Contin	ed Shelby uous Flic	/ Tube ht Auger		☑ At Comp	letio	n		Dry fl	<u>t.</u>		C D	FA - C C - D	ontinuo riving C	us Fligl asing	ht Augers
RC - Rock C CU - Cutting	Core										M	ID - M	lud Drill	ing	
CT - Contin	uous Tul	be												Pa	age <b>1</b> of <b>1</b>



CLIENT	BORING #	S-06
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE <u>#</u>	21IN0829
PROJECT LOCATION Indianapolis, IN		

		DRILLING a	and SAMPLING INFORMA	TION											
Date Sta	rted	11/21/21	Hammer Wt.	140	_lbs										
Date Completed 11/21/21		11/21/21	Hammer Drop	30	_in.	in.									
Boring M	ethod	HSA	Spoon Sampler (	DD <u>2</u>	_in.										
Driller	D. McV	Vherter	Rig Type CI	ME 55 ATV	_				~		t g	lgth	ter	°, cf)	
							1	be	raphics 3raphics	ater	enetrati ows/foo	onfined ve Strer	etrome	ontent % 'eight (p	
STRATA		SOIL	CLASSIFICATION		Ļ	<b>ب</b>	ole	ole Ty	oler G verv (	N pu	lard P N - bl	sf Unc pressi	sf et Per	ure C Jnit M	arks
ELEV.		SUR	FACE ELEVATION	Strat	Deptl	Dept	Sam  No.	Sam	Sam	Grou	Stano Test,	Qu-ts Com	PP-ts Pock	Moist Dry (	Rem
-			TOPSOIL	ſ	0.4	-									
		Brown a	nd Gray Sandy Silty CLAY	,			- 1	SS	X		7	0.8	1.0	17.9	
					5.0	5 -	2	SS	X		12		4.0	10.9	
		Bro	wn Silty Sandy CLAY			-  	3	SS	X		8	1.2	1.5	11.3	
				1	1.0	10 -	4	SS	X		36	3.5	4.5	6.9	
SS - Driven ST - Presse CA - Continn RC - Rock ( CU - Cutting CT - Continn	nple Typ Split Spi d Shelby uous Flig Core Js uous Tut	e pon / Tube ht Auger pe		O During D ♀ At Comp	Grou	<u>indwat</u> g n	er_	Dry fi Dry fi	t		H C D M	ISA - H IFA - C IC - D ID - M	Boring ollow S ontinuc riving C lud Drill	I Metho item Au us Fligi Casing ling	d gers ht Augers



CLIENT	BORING #	S-07
PROJECT NAME Liuna Local 120	ALT & WITZIG FILE <u>#</u>	21IN0829
PROJECT LOCATION Indianapolis, IN		



### **MATERIAL GRAPHICS LEGEND**





CL: USCS Low Plasticity Sandy Clay

TOPSOIL

SAMPLER SYMBOLS

### SOIL PROPERTY SYMBOLS

N: Standard "N" penetration value. Blows per foot of a 140-lb hammer falling 30" on a 2" O.D. split-spoon.Qu: Unconfined Compressive Strength, tsfPP:Pocket Penetrometer, tsfLL: Liquid Limit, %PL: Plastic Limit, %PI: Plasticity Index, %

### DRILLING AND SAMPLING SYMBOLS

#### GROUNDWATER SYMBOLS

• Apparent water level noted while drilling.

*♀* Apparent water level noted upon completion.

Apparent water level noted upon delayed time.

#### RELATIVE DENSITY & CONSISTANCY CLASSIFICATION (NON-COHESIVE SOILS)

<u>BLOWS PER FOOT</u> 0 - 5 6 - 10 11 - 30 31 - 50 >51

SS: Split Spoon

#### RELATIVE DENSITY & CONSISTANCY CLASSIFICATION (COHESIVE SOILS)

<u>TERM</u> Very Soft Soft Medium Stiff Stiff Very Stiff Hard BLOWS PER FOOT 0 - 3 4 - 5 6 - 10 11 - 15 16 - 30 >31



Alt & Witzig Engineering, Inc. 4105 West 99th St. Carmel, IN 46032 Telephone: 317-875-7000 Fax:

## **GENERAL NOTES**

Project: Liuna Local 120 Location: Indianapolis, IN Number: 21IN0829

NOTES - PROJECT SPECIFIC 211N0829 GINT.GPJ US EVAL.GDT 12/21/21



## APPENDIX **B**

Seismic Design Parameters Custom Soil Resource Report for Marion County, Indiana



# OSHPD

# 21IN0829

## Latitude, Longitude: 39.849189, -86.260727

Goog	gle	Cedar Lake Dr     Indiana       Prairie Creek Dr     Indiana       Indiana     Indiana       Indiana <t< th=""></t<>
Date		12/20/2021, 2:49:45 PM
Design Co	ode Referer	IBC-2015
Risk Cate	gory	II
Site Class	5	C - Very Dense Soil and Soft Rock
Туре	Value	Description
SS	0.158	MCE <sub>R</sub> ground motion. (for 0.2 second period)
S <sub>1</sub>	0.085	MCE <sub>R</sub> ground motion. (for 1.0s period)
S <sub>MS</sub>	0.19	Site-modified spectral acceleration value
S <sub>M1</sub>	0.145	Site-modified spectral acceleration value
S <sub>DS</sub>	0.127	Numeric seismic design value at 0.2 second SA
S <sub>D1</sub>	0.097	Numeric seismic design value at 1.0 second SA
Туре	Value	Description
SDC	В	Seismic design category
Fa	1.2	Site amplification factor at 0.2 second
Fv	1.7	Site amplification factor at 1.0 second
PGA	0.073	MCE <sub>G</sub> peak ground acceleration
F <sub>PGA</sub>	1.2	Site amplification factor at PGA
PGA <sub>M</sub>	0.087	Site modified peak ground acceleration
ΤL	12	Long-period transition period in seconds
SsRT	0.158	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.174	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.085	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.099	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.6	Factored deterministic acceleration value. (Peak Ground Acceleration)
C <sub>RS</sub>	0.909	Mapped value of the risk coefficient at short periods
C <sub>R1</sub>	0.864	Mapped value of the risk coefficient at a period of 1 s

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United States Department of Agriculture

Natural Resources Conservation

Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for Marion County, Indiana

21IN0829



# Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/? cid=nrcs142p2\_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Soil Map	5
Soil Map	6
Legend	7
Map Unit Legend	8
Map Unit Descriptions	8
Marion County, Indiana	10
UbaA—Urban land-Brookston complex, 0 to 2 percent slopes	10
YbvA—Brookston silty clay loam-Urban land complex, 0 to 2 percent	
slopes	11
YclA—Crosby silt loam, fine-loamy subsoil-Urban land complex, 0 to 2	
percent slopes	12
YmsB2—Miami silt loam-Urban land complex, 2 to 6 percent slopes,	
eroded	14

# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.



	MAP LE	EGEND		MAP INFORMATION					
Area of Interest	(AOI)	33	Spoil Area	The soil surveys that comprise your AOI were mapped at					
Area	rea of Interest (AOI)		Stony Spot	1.15,000.					
Soils	Man Linit Dahmana	0	Very Stony Spot	Warning: Soil Map may not be valid at this scale.					
Soli	Map Unit Polygons	v?	Wet Spot	······································					
🦰 Soil	Map Unit Lines	Å	Other	Enlargement of maps beyond the scale of mapping can cause					
Soil	Map Unit Points		Special Line Features	line placement. The maps do not show the small areas of					
Special Point	Special Point Features Blowout		tures	contrasting soils that could have been shown at a more detailed scale					
Bo XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	row Pit	$\sim$	Streams and Canals						
	iow Fit	Transporta	ation	Please rely on the bar scale on each map sheet for map					
		+++	Rails	measurements.					
♦ Close	sed Depression	~	Interstate Highways	Source of Map: Natural Resources Conservation Service					
💥 Gra	vel Pit	~	US Routes	Web Soil Survey URL:					
🔹 Gra	velly Spot	$\sim$	Major Roads	Coordinate System: Web Mercator (EPSG:3857)					
🚳 Lan	dfill	~	Local Roads	Maps from the Web Soil Survey are based on the Web Mercator					
🙏 Lav	a Flow	Backgrour	nd	projection, which preserves direction and shape but distorts					
🚲 Mar	sh or swamp	No.	Aerial Photography	Albers equal-area conic projection, should be used if more					
🙊 Min	Mine or Quarry			accurate calculations of distance or area are required.					
Mise	cellaneous Water			This product is generated from the USDA-NRCS certified data as					
O Per	ennial Water			of the version date(s) listed below.					
V Roc	k Outcrop			Soil Survey Area: Marion County. Indiana					
🛶 Sali	ne Spot			Survey Area Data: Version 26, Sep 8, 2021					
San	idy Spot			Soil map units are labeled (as space allows) for map scales					
Sev	verely Eroded Spot			1:50,000 or larger.					
👌 Sinl	khole			Date(s) aerial images were photographed: Aug 1 2018—Sep					
🐌 Slid	e or Slip			30, 2018					
j⊘ Sod	lic Spot			The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be ovident					

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
UbaA	Urban land-Brookston complex, 0 to 2 percent slopes	0.3	6.4%
YbvA	Brookston silty clay loam-Urban land complex, 0 to 2 percent slopes	0.1	1.1%
YcIA	Crosby silt loam, fine-loamy subsoil-Urban land complex, 0 to 2 percent slopes	1.0	22.5%
YmsB2	Miami silt loam-Urban land complex, 2 to 6 percent slopes, eroded	3.1	69.9%
Totals for Area of Interest		4.4	100.0%

# Map Unit Legend

# **Map Unit Descriptions**

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

## Marion County, Indiana

#### UbaA—Urban land-Brookston complex, 0 to 2 percent slopes

#### **Map Unit Setting**

National map unit symbol: 2y48h Elevation: 640 to 930 feet Mean annual precipitation: 36 to 42 inches Mean annual air temperature: 49 to 53 degrees F Frost-free period: 175 to 185 days Farmland classification: Not prime farmland

#### **Map Unit Composition**

*Urban land:* 60 percent *Brookston, drained, and similar soils:* 40 percent *Estimates are based on observations, descriptions, and transects of the mapunit.* 

#### **Description of Urban Land**

#### Setting

Landform: Till plains

#### Interpretive groups

Land capability classification (irrigated): None specified Other vegetative classification: Trees/Timber (Woody Vegetation) Hydric soil rating: Unranked

#### **Description of Brookston, Drained**

#### Setting

Landform: Depressions on till plains Landform position (two-dimensional): Footslope Down-slope shape: Concave Across-slope shape: Linear Parent material: Loess over loamy till

#### **Typical profile**

*H1 - 0 to 14 inches:* silty clay loam *H2 - 14 to 54 inches:* clay loam *H3 - 54 to 60 inches:* loam

#### **Properties and qualities**

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: High (about 9.7 inches)

#### Interpretive groups

Land capability classification (irrigated): None specified

#### **Custom Soil Resource Report**

Land capability classification (nonirrigated): 2w Hydrologic Soil Group: B/D Ecological site: F111AY007IN - Till Depression Flatwood Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation) Hydric soil rating: Yes

# YbvA—Brookston silty clay loam-Urban land complex, 0 to 2 percent slopes

#### Map Unit Setting

National map unit symbol: 2w57n Elevation: 600 to 1,260 feet Mean annual precipitation: 37 to 46 inches Mean annual air temperature: 48 to 55 degrees F Frost-free period: 145 to 180 days Farmland classification: Not prime farmland

#### Map Unit Composition

Brookston and similar soils: 65 percent Urban land: 30 percent Minor components: 5 percent Estimates are based on observations, descriptions, and transects of the mapunit.

#### **Description of Brookston**

#### Setting

Landform: Till plains, depressions Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Dip Down-slope shape: Linear, concave Across-slope shape: Concave Parent material: Loess over loamy till

#### Typical profile

Ap - 0 to 16 inches: silty clay loam Btg1 - 16 to 32 inches: silty clay loam Btg2 - 32 to 44 inches: loam C - 44 to 60 inches: loam

#### Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 40 percent

*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm) *Available water supply, 0 to 60 inches:* Moderate (about 8.9 inches)

#### Interpretive groups

Land capability classification (irrigated): None specified Land capability classification (nonirrigated): 2w Hydrologic Soil Group: B/D Ecological site: F111AY007IN - Till Depression Flatwood Hydric soil rating: Yes

#### **Minor Components**

#### Crosby

Percent of map unit: 5 percent Landform: Till plains Landform position (two-dimensional): Summit, footslope Landform position (three-dimensional): Talf Down-slope shape: Concave Across-slope shape: Linear Ecological site: F111AY008IN - Wet Till Ridge Hydric soil rating: No

# YcIA—Crosby silt loam, fine-loamy subsoil-Urban land complex, 0 to 2 percent slopes

#### **Map Unit Setting**

National map unit symbol: 2w57p Elevation: 600 to 1,040 feet Mean annual precipitation: 36 to 46 inches Mean annual air temperature: 48 to 55 degrees F Frost-free period: 145 to 180 days Farmland classification: Not prime farmland

#### Map Unit Composition

Crosby and similar soils: 60 percent Urban land: 30 percent Minor components: 10 percent Estimates are based on observations, descriptions, and transects of the mapunit.

#### **Description of Crosby**

#### Setting

Landform: Recessionial moraines, ground moraines, water-lain moraines Landform position (two-dimensional): Summit, backslope, footslope Landform position (three-dimensional): Interfluve, rise Down-slope shape: Convex, linear Across-slope shape: Linear, convex Parent material: Silty material or loess over loamy till

#### **Typical profile**

Ap - 0 to 10 inches: silt loam
*Btg - 10 to 17 inches:* silty clay loam *2Bt - 17 to 29 inches:* clay loam *2Bct - 29 to 36 inches:* loam *2Cd - 36 to 79 inches:* loam

# **Properties and qualities**

Slope: 0 to 2 percent
Depth to restrictive feature: 24 to 40 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 55 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

#### Interpretive groups

Land capability classification (irrigated): None specified Land capability classification (nonirrigated): 2w Hydrologic Soil Group: C/D Ecological site: F111AY008IN - Wet Till Ridge Hydric soil rating: No

# **Minor Components**

#### Treaty, drained

Percent of map unit: 5 percent Landform: Swales, water-lain moraines, depressions Landform position (two-dimensional): Footslope, toeslope Landform position (three-dimensional): Base slope, dip Down-slope shape: Linear Across-slope shape: Concave Ecological site: F111AY007IN - Till Depression Flatwood Hydric soil rating: Yes

#### Williamstown, eroded

Percent of map unit: 5 percent Landform: Recessionial moraines, ground moraines, water-lain moraines Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Head slope, nose slope, side slope, crest, rise

*Down-slope shape:* Linear, convex

Across-slope shape: Convex, linear

Ecological site: F111AY009IN - Till Ridge

Hydric soil rating: No

# YmsB2—Miami silt loam-Urban land complex, 2 to 6 percent slopes, eroded

#### Map Unit Setting

National map unit symbol: 2w586 Elevation: 180 to 1,040 feet Mean annual precipitation: 37 to 46 inches Mean annual air temperature: 48 to 55 degrees F Frost-free period: 145 to 180 days Farmland classification: Not prime farmland

#### Map Unit Composition

*Miami, eroded, and similar soils:* 50 percent *Urban land:* 35 percent *Minor components:* 15 percent *Estimates are based on observations, descriptions, and transects of the mapunit.* 

#### **Description of Miami, Eroded**

#### Setting

Landform: Till plains Landform position (two-dimensional): Shoulder, backslope, footslope Landform position (three-dimensional): Side slope Down-slope shape: Convex Across-slope shape: Linear Parent material: Loess over loamy till

#### **Typical profile**

Ap - 0 to 8 inches: silt loam Bt - 8 to 13 inches: silty clay loam 2Bt - 13 to 31 inches: clay loam 2BCt - 31 to 36 inches: loam 2Cd - 36 to 79 inches: loam

### **Properties and qualities**

Slope: 2 to 6 percent
Depth to restrictive feature: 24 to 40 inches to densic material
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.8 inches)

#### Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e Hydrologic Soil Group: C Ecological site: F111AY009IN - Till Ridge Other vegetative classification: Trees/Timber (Woody Vegetation) Hydric soil rating: No

#### **Minor Components**

#### Williamstown

Percent of map unit: 5 percent Landform: Till plains Landform position (two-dimensional): Shoulder, backslope Landform position (three-dimensional): Side slope Down-slope shape: Convex Across-slope shape: Linear Ecological site: F111AY009IN - Till Ridge Other vegetative classification: Trees/Timber (Woody Vegetation) Hydric soil rating: No

#### Treaty

Percent of map unit: 5 percent Landform: Till plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Dip Down-slope shape: Concave Across-slope shape: Concave Ecological site: F111AY007IN - Till Depression Flatwood Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation) Hydric soil rating: Yes

#### Crosby

Percent of map unit: 5 percent Landform: Till plains Landform position (two-dimensional): Summit Landform position (three-dimensional): Interfluve Down-slope shape: Linear Across-slope shape: Convex Ecological site: F111AY008IN - Wet Till Ridge Other vegetative classification: Trees/Timber (Woody Vegetation) Hydric soil rating: No

# DOCUMENT 00 41 13 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

#### 1.1 **BID INFORMATION**

- Bidder: Α.
- Β. Bid For: (List specification sections)
- C. Project Name: Laborer's International Union Local #120 New Union Hall.
- Project Location: 5440 Lafayette Rd. Indianapolis, IN 46254. D.
- Ε. Owner: Laborer's International Union Local 120, 1520 Riverside Dr., Indianapolis, IN, 46202.
- F. Architect: arcDESIGN, PC. Architect's Project Number: #21102 .
- General Contractor: Hannig Construction, Inc. Hannig Construction's Project Number: #6412 G.
- 1.2 CERTIFICATIONS AND BASE BID
  - Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully Α. examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by arcDESIGN, PC and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents. as follows:
  - Β. Union Hall Base Bid:

(\$

1.

Dollars.

).

2. The above amount may be modified by amounts indicated by the Bidder on the attached Document 004322 "Unit Prices Form" and Document 004323 "Alternates Form."

#### 1.3 ALTERNATE BIDS

Alternate Bid No. One: (Add Alternate). Α. 1.

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D

Β. Alternate Bid No. Two: (Add Alternate).

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	0 ollars. (\$).						
4 1	Alternate Bid No. Three: (Add Alternate). L.						
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ι	JNIT PRICES						
נ ג 1	Jnit Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil materia per cu. yd. L.						
	D Ollars. (\$). ALLOWANCES Exterior Signage Allowance (carried by Hannig Construction): \$75,000.00						
٦	TIME OF COMPLETION						
ר נ s	The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect and shall fully complete the Work within ten (10) months.						
ŀ	ACKNOWLEDGMENT OF ADDENDA						
	The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid: Addendum No. 1, dated Addendum No. 2, dated Addendum No. 3, dated Addendum No. 4, dated						
0	CONTRACTOR'S LICENSE						
The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in Indianapolis, Marion County, Indiana, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.							
S	SUBMISSION OF BID						
F	Respectfully submitted this day of						
5	Submitted By:(Name of bidding firm or corporation).						

LiUNA!			BID FORM - STIPUL	ATED SUM (S	INGLE-P	RIME
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SECTION 01 00 00 - GENERAL REQUIREMENTS

PART 1 - GENERAL (Not Used)

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 00 00

#### SECTION 01 10 00 - SUMMARY

#### PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Project information.
    - 2. Work covered by Contract Documents.
    - 3. Work under Owner's separate contracts.
    - 4. Owner-furnished/Contractor-installed (OFCI) products.
    - 5. Contractor's use of site and premises.
    - 6. Work restrictions.
    - 7. Specification and Drawing conventions.
  - B. Related Requirements:
    - 1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### 1.2 PROJECT INFORMATION

- A. Project Identification: Laborer's International Union Local Union #120.
  - 1. Project Location: 5440 Lafayette Rd., Indianapolis, IN 46254.
- B. Owner: LiUNA! Local 120.
  - 1. Owner's Representative: Mr. Ward Daniels.
- C. Architect: arcDESIGN, PC.
  - 1. Architect's Representative: Greg Miller, Project Manager.
- D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:
  - 1. Civil Engineer and Landscape Design: Civil & Environmental Consultants, Inc.
  - 2. Mechanical, Electrical, Plumbing, and Technology Design: The Genesis Engineering Group.
  - 3. Structural Engineering: Lynch, Harrison, and Brumleve, Inc.
- 1.3 WORK COVERED BY CONTRACT DOCUMENTS
  - A. The Work of Project is defined by the Contract Documents and consists of the following:
    - 1. New Union Hall and Site Development.
  - B. Type of Contract:
    - 1. Project will be constructed under a single prime contract.

# 1.4 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
  - 1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
  - 2. Provide for delivery of Owner-furnished products to Project site.
  - 3. Upon delivery, inspect, with Contractor present, delivered items.
    - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
  - 4. Obtain manufacturer's inspections, service, and warranties.
  - 5. Inform Contractor of earliest available delivery date for Owner-furnished products.
- B. Contractor's Responsibilities: The Work includes the following, as applicable:
  - 1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
  - 2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
  - 3. Receive, unload, handle, store, protect, and install Owner-furnished products.
  - 4. Make building services connections for Owner-furnished products.
  - 5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
  - 6. Repair or replace Owner-furnished products damaged following receipt.
- C. Owner-Furnished/Contractor-Installed (OFCI) Products:
  - 1. As indicated on the drawings. Reference Equipment Schedule provided on Drawing A-131.
  - 2. IT/Networking Equipment (cabling is included in the project).
  - 3. Residential & Commercial Kitchen Appliances (furnished through by Owner via FF&E package outside of Contract for Construction).
  - 4. Terminal Security Devices such as security cameras and networking equipment (cabling is included in the project).

#### 1.5 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- 1.6 WORK RESTRICTIONS
  - A. Comply with restrictions on construction operations.
    - 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
  - B. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances within the building is not permitted.

### 1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  - 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
  - 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
  - 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

#### SECTION 01 21 00 - ALLOWANCES

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section includes administrative and procedural requirements governing allowances.
  - B. Types of allowances include the following:1. Lump-sum allowances.
  - C. Related Requirements:
    - 1. Section 01 22 00 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.

#### 1.2 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.
- 1.3 ACTION SUBMITTALS
  - A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.
- 1.4 INFORMATIONAL SUBMITTALS
  - A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
  - B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
  - C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.
- 1.5 LUMP-SUM ALLOWANCES
  - A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

ALLOWANCES 01 21 00 - 1 Copyright © 2021 by the American Institute of Architects. Warning: This AIA MasterSpec-based document is protected by U.S. Copyright Law and International Treaties. It was created by "arcDESIGN, PC" for "Local Union 120". A valid, current MasterSpec license is required for editing and use of this document for any other project.(13619)

- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- PART 2 PRODUCTS (Not Used)
- PART 3 EXECUTION
- 3.1 EXAMINATION
  - A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.
- 3.2 PREPARATION
  - A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.
- 3.3 SCHEDULE OF ALLOWANCES
  - A. Allowance No. 1: Quantity Allowance: Include 2000 cu. yd. of unsatisfactory soil excavation and disposal off-site and replacement with satisfactory soil material from off-site.
    - Coordinate quantity allowance adjustment with unit-price requirements in Section 01 22 00 "Unit Prices."
  - B. Allowance No. 2: Lump Sum Allowance: Include the sum of \$5,000 for miscellaneous bracing of interior partitions as directed by the Architect.
  - C. Allowance No. 3: Contingency Allowance: Include a contingency allowance of \$100,000.00 for use according to Owner's written instructions.

END OF SECTION 01 21 00

#### SECTION 01 22 00 - UNIT PRICES

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
  - 1. Section 01 21 00 "Allowances" for procedures for using unit prices to adjust quantity allowances.

#### 1.2 DEFINITIONS

A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

#### 1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

#### PART 2 - PRODUCTS (Not Used)

#### PART 3 - EXECUTION

#### 3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Unsuitable Soils: includes removal and hauling off site of unsuitable soil, and replacement with fill and compaction per cu. yd.

END OF SECTION 01 22 00

#### SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

#### 1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
  - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

#### 1.3 PROCEDURES

- A. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.
- PART 2 PRODUCTS (Not Used)
- PART 3 EXECUTION
- 3.1 SCHEDULE OF ALTERNATES

#### A. Alternate No. :1: Metal Building Wall Panel System Finish .

- 1. Base Bid: PVDF wall panel system finish (Ref. Sheet A101).
- 2. Alternate: Siliconized Polyester wall panel system finish (Ref. Sheet A101).
- B. Alternate No. 2: Metal Building Roof Panel System Finish:
  - 1. Base Bid: PVDF roof panel system finish (Ref. Sheet A101).
  - 2. Alternate: Galvalume Plus roof panel system finish (Ref. Sheet A101).
- C. Alternate No. 3.: Metal Building Insulation:
  - 1. Base Bid: R-19 Sag & Bag Insulation with Vapor Retarder and air barrier system at the roof and walls.
  - 2. Alternate: Therm-All Proliner Insulation System (R-25) at roof and walls.
- D. Alternate No. 4: Metal Liner Panel

- 1. Base Bid: Provide KirbyRib acoustical liner panel at roof/ceiling and walls of the HALL not covered with gypsum board partitions.
- 2. Alternate: Omit KirbyRib acoustical liner panel at roof/ceiling and walls of the HALL not covered with gypsum board partitions. Note that this deduct alternate is paired with acceptance of Alternate #3.
- E. Alternate No. 5: **Dumpster Enclosure** 
  - 1. Base Bid: Decorative concrete block walls and BaSteel Infinity Double Swing Gate with PVDF Black finish as indicated on the drawings.
  - 2. Alternate Bid: Black Vinyl Coated Chain-link fence posts, top, bottom, and mid-rails, and swing gates with vertical black PBR metal panels attached to rails and posts in lieu of chain link fence fabric.

# F. Alternate No. 6: Canopy MCM System:

- 1. BASE BID: Provide CITADEL 2000 ENVELOPE 2000 RS as indicated in the drawings and specifications.
- 2. ALTERNATE BID: Provide CITADEL ENVELOPE 2000 REVEAL (RV) with Batten moldings and custom coping over adhered air barrier / WRB.

END OF SECTION 01 23 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

# 1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.
    - a. Substitutions for Convenience: Not Allowed.

#### 1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use form provided in Project Manual .
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
    - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - e. Samples, where applicable or requested.

- f. Certificates and qualification data, where applicable or requested.
- g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
- h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES .
- j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- I. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
- m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
  - a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

# 1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

# 1.5 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

# 1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

- 1. Conditions: Architect will consider Subcontractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Substitution request is fully documented and properly submitted.
  - c. Requested substitution will not adversely affect Contractor's construction schedule.
  - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - e. Requested substitution is compatible with other portions of the Work.
  - f. Requested substitution has been coordinated with other portions of the Work.
  - g. Requested substitution provides specified warranty.
  - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- PART 2 PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

### SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

#### PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

# 1.2 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, on AIA Document G710.
  - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.

#### 1.3 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. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within seven (7) 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.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim 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.
  - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

- 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
- 4. Include costs of labor and supervision directly attributable to the change.
- 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- 6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
- 7. Extra work performed under 1.3.A & 1.3.B above shall be performed for the cost of labor payroll (base rate + fringes) plus 28.5% of the labor payroll and a total overhead and profit markup of 7.5% of the total additional cost. Said markup fees are intended to compensate for the cost of payroll taxes, insurance of all kinds, all taxes, including State Taxes, Federal Income Tax, Unemployment, and FICA Taxes, as well as all other overhead costs, expenses, and carrying charges whatsoever, including the profit to be derived from such additional work. Labor payroll is defined as the actual hourly labor cost plus any fringes payable.

# 1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

# 1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
- PART 2 PRODUCTS (Not Used)
- PART 3 EXECUTION (Not Used)

END OF SECTION 01 26 00

### SECTION 01 29 00 - PAYMENT PROCEDURES

### PART 1 - GENERAL

# 1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

# 1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
  - 2. Submit the schedule of values to Architect at earliest possible date, but no later than forty (40) days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
  - 1. Arrange schedule of values consistent with format of AIA Document G703.
  - 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
  - 3. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    - a. Differentiate between items stored on-site and items stored off-site.
  - 4. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
  - 5. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
  - 6. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
  - 7. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

# 1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit one (1) digital PDF application signed and notarized of each Application for Payment to Architect by a method ensuring receipt within 24 hours. Digital (PDF) copy shall include waivers of lien and similar attachments if required.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
  - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  - 2. When an application shows completion of an item, submit conditional final or full waivers.
  - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  - 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  - 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
  - 1. List of subcontractors.
  - 2. Schedule of values.
  - 3. Contractor's construction schedule (preliminary if not final).
  - 4. Products list (preliminary if not final).
  - 5. Sustainable design action plans, including preliminary project materials cost data.
  - 6. Schedule of unit prices.
  - 7. Submittal schedule (preliminary if not final).

- 8. List of Contractor's staff assignments.
- 9. List of Contractor's principal consultants.
- 10. Copies of building permits.
- 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
- 12. Initial progress report.
- 13. Report of preconstruction conference.
- 14. Certificates of insurance and insurance policies.
- 15. Performance and payment bonds.
- 16. Data needed to acquire Owner's insurance.
- H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
  - 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  - 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
  - 1. Evidence of completion of Project closeout requirements.
  - 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  - 3. Updated final statement, accounting for final changes to the Contract Sum.
  - 4. AIA Document G706.
  - 5. AIA Document G706A.
  - 6. AIA Document G707.
  - 7. Evidence that claims have been settled.
  - 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

# SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
    - 1. General coordination procedures.
    - 2. Coordination drawings.
    - 3. RFIs.
    - 4. Digital project management procedures.
    - 5. Project meetings.
  - B. Related Requirements:
    - 1. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

### 1.2 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.

#### 1.3 GENERAL COORDINATION PROCEDURES

- 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 to ensure maximum performance and accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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.

### 1.4 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - b. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
  - 1. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
  - 2. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
  - 3. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  - 4. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
  - 5. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
  - 1. File Preparation Format:
    - a. DWG, Version 2013, operating in Microsoft Windows operating system.

- 2. File Submittal Format: Submit or post coordination drawing files using PDF format.
- 3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
  - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
  - b. Digital Data Software Program: Drawings are available in Revit 2020 and AutoCAD 2013 .
  - c. Contractor shall execute a data licensing agreement in the form of AIA Document C106.
- 1.5 REQUEST FOR INFORMATION (RFI)
  - A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
    - 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
    - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
  - B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
    - 1. Owner name.
    - 2. Owner's Project number.
    - 3. Name of Architect.
    - 4. Architect's Project number.
    - 5. Date.
    - 6. Name of Contractor.
    - 7. RFI number, numbered sequentially.
    - 8. RFI subject.
    - 9. Specification Section number and title and related paragraphs, as appropriate.
    - 10. Drawing number and detail references, as appropriate.
    - 11. Field dimensions and conditions, as appropriate.
    - 12. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
    - 13. Contractor's signature.
    - 14. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
  - C. RFI Forms: AIA Document G716 .
  - D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
    - 1. The following Contractor-generated RFIs will be returned without action:
      - a. Requests for approval of submittals.

- b. Requests for approval of substitutions.
- c. Requests for approval of Contractor's means and methods.
- d. Requests for coordination information already indicated in the Contract Documents.
- e. Requests for adjustments in the Contract Time or the Contract Sum.
- f. Requests for interpretation of Architect's actions on submittals.
- g. Incomplete RFIs or inaccurately prepared RFIs.
- 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
- 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
  - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly. 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 returned without action or withdrawn.
  - 5. RFI description.
  - 6. Date the RFI was submitted.
  - 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

# 1.6 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model CAD drawings will be provided by Architect for Contractor's use during construction.
  - 1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
  - 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
  - 3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD 2013.
  - 4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement .
    - a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.
  - 5. The following digital data files will be furnished for each appropriate discipline:
    - a. Floor plans.

- b. Reflected ceiling plans.
- c. Roof Plans.
- d. Building Elevations.
- B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
  - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2. Name file with submittal number or other unique identifier, including revision identifier.
  - 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

#### 1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
- B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
  - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  - 2. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 3. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  - 4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- C. Progress Meetings: The General Contractor shall conduct progress meetings at biweekly intervals.
  - 1. Coordinate dates of meetings with preparation of payment requests.
  - 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Review 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.

- 1) Review schedule for next period.
- b. Review present and future needs of each entity present.
- 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
  - 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

# SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

#### PART 1 - GENERAL

### 1.1 SUMMARY

- A. 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. Construction schedule updating reports.
  - 3. Site condition reports.

# 1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

# 1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. Working electronic copy of schedule file.
  - 2. PDF file.

- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
  - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
  - 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
  - 2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
  - 3. Total Float Report: List of activities sorted in ascending order of total float.
- D. Construction Schedule Updating Reports: Submit with Applications for Payment.
- E. Site Condition Reports: Submit at time of discovery of differing conditions.

# 1.4 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

# 1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
  - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
  - 2. 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.

- Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
- 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
- 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
- 6. Punch List and Final Completion: Include not more than fifteen (15) days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
  - 1. Phasing: Arrange list of activities on schedule by phase.
  - 2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  - 3. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use-of-premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
- D. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
  - 1. Unresolved issues.
  - 2. Unanswered Requests for Information.
  - 3. Rejected or unreturned submittals.
  - 4. Notations on returned submittals.
  - 5. Pending modifications affecting the Work and the Contract Time.
- E. Contractor's Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule before each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  - 3. As the Work progresses, indicate final completion percentage for each activity.
- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to

working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

- G. 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.
  - 1. Post copies in Project meeting rooms and temporary field offices.
  - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

#### 1.6 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work .
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
  - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

#### 1.7 REPORTS

A. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 00

# SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

#### PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Concealed Work photographs.
  - 2. Periodic construction photographs.
  - 3. Final completion construction photographs.
- B. Related Requirements:
  - 1. Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
  - 2. Section 02 41 16 "Structure Demolition" for photographic documentation before building demolition operations commence.
  - 3. Section 02 41 19 "Selective Demolition" for photographic documentation before selective demolition operations commence.
  - 4. Section 31 10 00 "Site Clearing" for photographic documentation before site clearing operations commence.

#### 1.2 INFORMATIONAL SUBMITTALS

- A. Digital Photographs: Submit image files within three days of taking photographs.
  - 1. Submit photos on CD-ROM or thumb-drive . Include copy of key plan indicating each photograph's location and direction.
  - 2. Identification: Provide the following information with each image description in file metadata tag :
    - a. Name of Project.
    - b. Name of Contractor.
    - c. Date photograph was taken.

#### 1.3 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- C. Metadata: Record accurate date and time from camera.
- D. File Names: Name media files with date and sequential numbering suffix.

# 1.4 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs with maximum depth of field and in focus.
  - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
  - 1. Underground utilities.
  - 2. Underslab services.
  - 3. In-wall services including technology, electrical, plumbing, and HVAC.
  - 4. Piping.
  - 5. Electrical conduit.
  - 6. Waterproofing and weather-resistant barriers.
- C. Periodic Construction Photographs: Take 10 photographs coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- D. Final Completion Construction Photographs: Take 100 photographs after date of Substantial Completion for submission as Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 33

# SECTION 01 33 00 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 **SUMMARY**

#### Α. Section Includes:

- 1. Submittal schedule requirements.
- Administrative and procedural requirements for submittals. 2.

#### 1.2 DEFINITIONS

- Action Submittals: Written and graphic information and physical samples that require Α. Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- Β. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

#### 1.3 SUBMITTAL SCHEDULE

Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in Α. chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

#### 1.4 SUBMITTAL FORMATS

- Α. Submittal Information: Include the following information in each submittal:
  - 1. Project name.
  - 2. Date.
  - 3. Name of Architect.
  - 4. Name of Construction Manager.
  - 5. Name of Contractor.
  - Name of firm or entity that prepared submittal. 6.
  - 7. Names of subcontractor, manufacturer, and supplier.
  - 8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
  - Number and title of Specification Section, with paragraph number and generic name for 9. each of multiple items.
  - 10. Drawing number and detail references, as appropriate.
  - Indication of full or partial submittal. 11.

# SUBMITTAL PROCEDURES
- 12. Remarks.
- 13. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect and Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

### 1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  - 1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Construction Manager's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
  - 2. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

## 1.6 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each copy of each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Notation of coordination requirements.
  - 4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams that show factory-installed wiring.
    - b. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  - 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
  - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
  - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    - a. Project name and submittal number.
    - b. Generic description of Sample.
    - c. Product name and name of manufacturer.
    - d. Sample source.
    - e. Number and title of applicable Specification Section.
    - f. Specification paragraph number and generic name of each item.

- 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
- 4. Disposition: Maintain sets of approved Samples at Project site, available for qualitycontrol comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
  - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
  - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
  - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect , through Construction Manager, will return submittal with options selected.
- 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
  - a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
    - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
    - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

# 1.7 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

- B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

### 1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp . Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
  - 1. Architect and Construction Manager will not review submittals received from Contractor that do not have Contractor's review and approval.

### 1.9 ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

- A. Action Submittals: Architect and Construction Manager will review each submittal, indicate corrections or revisions required , and return it.
  - 1. PDF Submittals: Architect and Construction Manager will indicate, via markup on each submittal, the appropriate action .
- B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.
- C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- D. Architect and Construction Manager will return without review submittals received from sources other than Contractor.
- E. Submittals not required by the Contract Documents will be returned by Architect without action.
- PART 2 PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

### SECTION 01 40 00 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specified tests, inspections, and related actions do not limit Contractor's other qualityassurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
  - 2. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

### 1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
  - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

- F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
- H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

### 1.3 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated Design Services Statement: Submit a statement, signed and sealed by the responsible design professional licensed in the State of Indiana, for each product and system specifically assigned to Contractor to be designed or certified by a design professional licensed in the State of Indiana, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

## 1.4 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
  - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
  - 2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

### 1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, telephone number, and email address of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
  - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 12. Name and signature of laboratory inspector.
  - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
  - 1. Statement on condition of substrates and their acceptability for installation of product.
  - 2. Statement that products at Project site comply with requirements.
  - 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  - 4. Other required items indicated in individual Specification Sections.

- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
  - 1. Statement that equipment complies with requirements.
  - 2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  - 3. Other required items indicated in individual Specification Sections.

### 1.7 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Indiana where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E329 ; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

### 1.8 QUALITY CONTROL

- A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
  - 1. Engage a qualified testing agency to perform quality-control services.
    - a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  - 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
  - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  - 4. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- C. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
  - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
  - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  - 6. Do not perform duties of Contractor.
- D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."
- E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

- F. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
  - 4. Facilities for storage and field curing of test samples.
  - 5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  - 6. Security and protection for samples and for testing and inspection equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## 1.9 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner may engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
  - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
  - 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
  - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  - 6. Retesting and reinspecting corrected Work.

## PART 2 - PRODUCTS (Not Used)

- PART 3 EXECUTION
- 3.1 TEST AND INSPECTION LOG
  - A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
    - 1. Date test or inspection was conducted.
    - 2. Description of the Work tested or inspected.
    - 3. Date test or inspection results were transmitted to Architect.

- 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.
  - 1. Submit log at Project closeout as part of Project Record Documents.
- 3.2 REPAIR AND PROTECTION
  - A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
    - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."
  - B. Protect construction exposed by or for quality-control service activities.
  - C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

#### SECTION 01 42 00 - REFERENCES

#### PART 1 - GENERAL

#### 1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

### 1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
  - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

### 1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.
  - 1. AABC Associated Air Balance Council; www.aabc.com.
  - 2. AAMA American Architectural Manufacturers Association; www.aamanet.org.
  - 3. AAPFCO Association of American Plant Food Control Officials; www.aapfco.org.
  - 4. AASHTO American Association of State Highway and Transportation Officials; www.transportation.org.
  - 5. AATCC American Association of Textile Chemists and Colorists; www.aatcc.org.
  - 6. ABMA American Bearing Manufacturers Association; www.americanbearings.org.
  - 7. ABMA American Boiler Manufacturers Association; www.abma.com.
  - 8. ACI American Concrete Institute; (Formerly: ACI International); www.concrete.org.
  - 9. ACPA American Concrete Pipe Association; www.concrete-pipe.org.
  - 10. AEIC Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
  - 11. AF&PA American Forest & Paper Association; www.afandpa.org.
  - 12. AGA American Gas Association; www.aga.org.
  - 13. AHAM Association of Home Appliance Manufacturers; www.aham.org.
  - 14. AHRI Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
  - 15. AI Asphalt Institute; www.asphaltinstitute.org.
  - 16. AIA American Institute of Architects (The); www.aia.org.
  - 17. AISC American Institute of Steel Construction; www.aisc.org.
  - 18. AISI American Iron and Steel Institute; www.steel.org.
  - 19. AITC American Institute of Timber Construction; www.aitc-glulam.org.
  - 20. AMCA Air Movement and Control Association International, Inc.; www.amca.org.
  - 21. ANSI American National Standards Institute; www.ansi.org.
  - 22. AOSA Association of Official Seed Analysts, Inc.; www.aosaseed.com.
  - 23. APA APA The Engineered Wood Association; www.apawood.org.
  - 24. APA Architectural Precast Association; www.archprecast.org.
  - 25. API American Petroleum Institute; www.api.org.
  - 26. ARI Air-Conditioning & Refrigeration Institute; (See AHRI).
  - 27. ARI American Refrigeration Institute; (See AHRI).
  - 28. ARMA Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
  - 29. ASCE American Society of Civil Engineers; www.asce.org.
  - 30. ASCE/SEI American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
  - 31. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
  - 32. ASME ASME International; (American Society of Mechanical Engineers); www.asme.org.
  - 33. ASSE American Society of Sanitary Engineering; www.asse-plumbing.org.
  - 34. ASSP American Society of Safety Professionals (The); www.assp.org.

- 35. ASTM ASTM International; www.astm.org.
- 36. ATIS Alliance for Telecommunications Industry Solutions; www.atis.org.
- 37. AVIXA Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); www.soundandcommunications.com.
- 38. AWEA American Wind Energy Association; www.awea.org.
- 39. AWI Architectural Woodwork Institute; www.awinet.org.
- 40. AWMAC Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
- 41. AWPA American Wood Protection Association; www.awpa.com.
- 42. AWS American Welding Society; www.aws.org.
- 43. AWWA American Water Works Association; www.awwa.org.
- 44. BHMA Builders Hardware Manufacturers Association; www.buildershardware.com.
- 45. BIA Brick Industry Association (The); www.gobrick.com.
- 46. BICSI BICSI, Inc.; www.bicsi.org.
- 47. BIFMA BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
- 48. BISSC Baking Industry Sanitation Standards Committee; www.bissc.org.
- 49. BWF Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
- 50. CDA Copper Development Association; www.copper.org.
- 51. <u>CE Conformite Europeenne; http:</u> //ec.europa.eu/growth/single-market/ce-marking.
- 52. CEA Canadian Electricity Association; www.electricity.ca.
- 53. CFFA Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
- 54. CFSEI Cold-Formed Steel Engineers Institute; www.cfsei.org.
- 55. CGA Compressed Gas Association; www.cganet.com.
- 56. CIMA Cellulose Insulation Manufacturers Association; www.cellulose.org.
- 57. CISCA Ceilings & Interior Systems Construction Association; www.cisca.org.
- 58. CISPI Cast Iron Soil Pipe Institute; www.cispi.org.
- 59. CLFMI Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
- 60. CPA Composite Panel Association; www.compositepanel.org.
- 61. CRI Carpet and Rug Institute (The); www.carpet-rug.org.
- 62. CRRC Cool Roof Rating Council; www.coolroofs.org.
- 63. CRSI Concrete Reinforcing Steel Institute; www.crsi.org.
- 64. CSA CSA Group; www.csa-group.org.
- 65. CSI Construction Specifications Institute (The); www.csiresources.org.
- 66. CSSB Cedar Shake & Shingle Bureau; www.cedarbureau.org.
- 67. CTA Consumer Technology Association; www.cta.tech.
- 68. CTI Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org.
- 69. CWC Composite Wood Council; (See CPA).
- 70. DASMA Door and Access Systems Manufacturers Association; www.dasma.com.
- 71. DHA Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); www.decorativehardwoods.org.
- 72. DHI Door and Hardware Institute; www.dhi.org.
- 73. ECA Electronic Components Association; (See ECIA).
- 74. ECAMA Electronic Components Assemblies & Materials Association; (See ECIA).

- 75. ECIA Electronic Components Industry Association; www.ecianow.org.
- 76. EIA Electronic Industries Alliance; (See TIA).
- 77. EIMA EIFS Industry Members Association; www.eima.com.
- 78. EJMA Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
- 79. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
- 80. ESTA Entertainment Services and Technology Association; (See PLASA).
- 81. ETL Intertek (See Intertek); www.intertek.com.
- 82. EVO Efficiency Valuation Organization; www.evo-world.org.
- 83. FCI Fluid Controls Institute; www.fluidcontrolsinstitute.org.
- 84. FIBA Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
- 85. FIVB Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
- 86. FM Approvals FM Approvals LLC; www.fmglobal.com.
- 87. FM Global FM Global; (Formerly: FMG FM Global); www.fmglobal.com.
- 88. FRSA Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
- 89. FSA Fluid Sealing Association; www.fluidsealing.com.
- 90. FSC Forest Stewardship Council U.S.; www.fscus.org.
- 91. GA Gypsum Association; www.gypsum.org.
- 92. GANA Glass Association of North America; (See NGA).
- 93. GS Green Seal; www.greenseal.org.
- 94. HI Hydraulic Institute; www.pumps.org.
- 95. HI/GAMA Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
- 96. HMMA Hollow Metal Manufacturers Association; (See NAAMM).
- 97. HPVA Hardwood Plywood & Veneer Association; (See DHA).
- 98. HPW H. P. White Laboratory, Inc.; www.hpwhite.com.
- 99. IAPSC International Association of Professional Security Consultants; www.iapsc.org.
- 100. IAS International Accreditation Service; www.iasonline.org.
- 101. ICBO International Conference of Building Officials; (See ICC).
- 102. ICC International Code Council; www.iccsafe.org.
- 103. ICEA Insulated Cable Engineers Association, Inc.; www.icea.net.
- 104. ICPA International Cast Polymer Association; www.theicpa.com.
- 105. ICRI International Concrete Repair Institute, Inc.; www.icri.org.
- 106. IEC International Electrotechnical Commission; www.iec.ch.
- 107. IEEE Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
- 108. IES Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
- 109. IESNA Illuminating Engineering Society of North America; (See IES).
- 110. IEST Institute of Environmental Sciences and Technology; www.iest.org.
- 111. IGMA Insulating Glass Manufacturers Alliance; www.igmaonline.org.
- 112. IGSHPA International Ground Source Heat Pump Association; www.igshpa.org.
- 113. II Infocomm International; (See AVIXA).
- 114. ILI Indiana Limestone Institute of America, Inc.; www.iliai.com.
- 115. Intertek Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.

REFERENCES 01 42 00 - 5 arcDESIGN, PC

- 116. ISA International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
- 117. ISAS Instrumentation, Systems, and Automation Society (The); (See ISA).
- 118. ISFA International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
- 119. ISO International Organization for Standardization; www.iso.org.
- 120. ISSFA International Solid Surface Fabricators Association; (See ISFA).
- 121. ITU International Telecommunication Union; www.itu.int.
- 122. KCMA Kitchen Cabinet Manufacturers Association; www.kcma.org.
- 123. LMA Laminating Materials Association; (See CPA).
- 124. LPI Lightning Protection Institute; www.lightning.org.
- 125. MBMA Metal Building Manufacturers Association; www.mbma.com.
- 126. MCA Metal Construction Association; www.metalconstruction.org.
- 127. MFMA Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
- 128. MFMA Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
- 129. MHIA Material Handling Industry of America; www.mhia.org.
- 130. MIA Marble Institute of America; (See NSI).
- 131. MMPA Moulding & Millwork Producers Association; www.wmmpa.com.
- 132. MPI Master Painters Institute; www.paintinfo.com.
- 133. MSS Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
- 134. NAAMM National Association of Architectural Metal Manufacturers; www.naamm.org.
- 135. NACE NACE International; (National Association of Corrosion Engineers International); www.nace.org.
- 136. NADCA National Air Duct Cleaners Association; www.nadca.com.
- 137. NAIMA North American Insulation Manufacturers Association; www.naima.org.
- 138. NALP National Association of Landscape Professionals; www.landscapeprofessionals.org.
- 139. NBGQA National Building Granite Quarries Association, Inc.; www.nbgqa.com.
- 140. NBI New Buildings Institute; www.newbuildings.org.
- 141. NCAA National Collegiate Athletic Association (The); www.ncaa.org.
- 142. NCMA National Concrete Masonry Association; www.ncma.org.
- 143. NEBB National Environmental Balancing Bureau; www.nebb.org.
- 144. NECA National Electrical Contractors Association; www.necanet.org.
- 145. NeLMA Northeastern Lumber Manufacturers Association; www.nelma.org.
- 146. NEMA National Electrical Manufacturers Association; www.nema.org.
- 147. NETA InterNational Electrical Testing Association; www.netaworld.org.
- 148. NFHS National Federation of State High School Associations; www.nfhs.org.
- 149. NFPA National Fire Protection Association; www.nfpa.org.
- 150. NFPA NFPA International; (See NFPA).
- 151. NFRC National Fenestration Rating Council; www.nfrc.org.
- 152. NGA National Glass Association (The); (Formerly: Glass Association of North America); www.glass.org.
- 153. NHLA National Hardwood Lumber Association; www.nhla.com.
- 154. NLGA National Lumber Grades Authority; www.nlga.org.
- 155. NOFMA National Oak Flooring Manufacturers Association; (See NWFA).

REFERENCES 01 42 00 - 6 arcDESIGN, PC

- 156. NOMMA National Ornamental & Miscellaneous Metals Association; www.nomma.org.
- 157. NRCA National Roofing Contractors Association; www.nrca.net.
- 158. NRMCA National Ready Mixed Concrete Association; www.nrmca.org.
- 159. NSF NSF International; www.nsf.org.
- 160. NSI National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
- 161. NSPE National Society of Professional Engineers; www.nspe.org.
- 162. NSSGA National Stone, Sand & Gravel Association; www.nssga.org.
- 163. NTMA National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
- 164. NWFA National Wood Flooring Association; www.nwfa.org.
- 165. <u>NWRA National Waste & Recycling Association; www.wasterecycling.org.</u>
- 166. PCI Precast/Prestressed Concrete Institute; www.pci.org.
- 167. PDI Plumbing & Drainage Institute; www.pdionline.org.
- 168. PLASA PLASA; (Formerly: ESTA Entertainment Services and Technology Association); www.plasa.org.
- 169. RCSC Research Council on Structural Connections; www.boltcouncil.org.
- 170. RFCI Resilient Floor Covering Institute; www.rfci.com.
- 171. RIS Redwood Inspection Service; www.redwoodinspection.com.
- 172. SAE SAE International; www.sae.org.
- 173. SCTE Society of Cable Telecommunications Engineers; www.scte.org.
- 174. SDI Steel Deck Institute; www.sdi.org.
- 175. SDI Steel Door Institute; www.steeldoor.org.
- 176. SEFA Scientific Equipment and Furniture Association (The); www.sefalabs.com.
- 177. SEI/ASCE Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
- 178. SIA Security Industry Association; www.siaonline.org.
- 179. SJI Steel Joist Institute; www.steeljoist.org.
- 180. SMA Screen Manufacturers Association; www.smainfo.org.
- 181. SMACNA Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
- 182. SMPTE Society of Motion Picture and Television Engineers; www.smpte.org.
- 183. SPFA Spray Polyurethane Foam Alliance; www.sprayfoam.org.
- 184. SPIB Southern Pine Inspection Bureau; www.spib.org.
- 185. SPRI Single Ply Roofing Industry; www.spri.org.
- 186. SRCC Solar Rating & Certification Corporation; www.solar-rating.org.
- 187. SSINA Specialty Steel Industry of North America; www.ssina.com.
- 188. SSPC SSPC: The Society for Protective Coatings; www.sspc.org.
- 189. STI Steel Tank Institute; www.steeltank.com.
- 190. SWI Steel Window Institute; www.steelwindows.com.
- 191. SWPA Submersible Wastewater Pump Association; www.swpa.org.
- 192. TCA Tilt-Up Concrete Association; www.tilt-up.org.
- 193. TCNA Tile Council of North America, Inc.; www.tileusa.com.
- 194. TEMA Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
- 195. TIA Telecommunications Industry Association (The); (Formerly: TIA/EIA Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.

REFERENCES 01 42 00 - 7 arcDESIGN, PC

- 196. TIA/EIA Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
- 197. TMS The Masonry Society; www.masonrysociety.org.
- 198. TPI Truss Plate Institute; www.tpinst.org.
- 199. TPI Turfgrass Producers International; www.turfgrasssod.org.
- 200. TRI Tile Roofing Institute; www.tileroofing.org.
- 201. UL Underwriters Laboratories Inc.; www.ul.com.
- 202. UNI Uni-Bell PVC Pipe Association; www.uni-bell.org.
- 203. USAV USA Volleyball; www.usavolleyball.org.
- 204. USGBC U.S. Green Building Council; www.usgbc.org.
- 205. USITT United States Institute for Theatre Technology, Inc.; www.usitt.org.
- 206. WA Wallcoverings Association; www.wallcoverings.org.
- 207. WCLIB West Coast Lumber Inspection Bureau; www.wclib.org.
- 208. WCMA Window Covering Manufacturers Association; www.wcmanet.org.
- 209. WDMA Window & Door Manufacturers Association; www.wdma.com.
- 210. WI Woodwork Institute; www.wicnet.org.
- 211. WSRCA Western States Roofing Contractors Association; www.wsrca.com.
- 212. WWPA Western Wood Products Association; www.wwpa.org.
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
  - 1. DIN Deutsches Institut fur Normung e.V.; www.din.de.
  - 2. IAPMO International Association of Plumbing and Mechanical Officials; www.iapmo.org.
  - 3. ICC International Code Council; www.iccsafe.org.
  - 4. ICC-ES ICC Evaluation Service, LLC; www.icc-es.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
  - 1. CPSC Consumer Product Safety Commission; www.cpsc.gov.
  - 2. EPA Environmental Protection Agency; www.epa.gov.
  - 3. FAA Federal Aviation Administration; www.faa.gov.
  - 4. OSHA Occupational Safety & Health Administration; www.osha.gov.
  - 5. TRB Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
  - 6. USDA Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
  - 7. USPS United States Postal Service; www.usps.com.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

- 1. CFR Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
- 2. FED-STD Federal Standard; (See FS).
- 3. FS Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
  - a. Available from Defense Standardization Program; www.dsp.dla.mil.
  - b. Available from General Services Administration; www.gsa.gov.
  - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
- 4. USAB United States Access Board; www.access-board.gov.
- 5. USATBCB U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
  - 1. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

### SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
  - B. Related Requirements:
    - 1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.
- 1.2 INFORMATIONAL SUBMITTALS
  - A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
  - B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
  - C. <u>Erosion and Sedimentation Control Plan</u>: Show compliance with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
  - D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
  - E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
    - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
    - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
    - 3. Indicate methods to be used to avoid trapping water in finished work.

### 1.3 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its

use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

### PART 2 - PRODUCTS

### 2.1 TEMPORARY FACILITIES

A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

### 2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
  - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 12 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures."
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

### PART 3 - EXECUTION

### 3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
  - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

### 3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- C. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
  - 1. Install electric power service underground unless otherwise indicated.
- D. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- E. Telephone / Internet Service: Provide temporary Internet service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment telephone line(s) for each field office.
- F. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

### 3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
  - 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241.
  - 2. Utilize designated area within existing building for temporary field offices.
  - 3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
  - 1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.

- C. Parking: Provide designated temporary parking areas for construction personnel.
- D. Storage and Staging: Use designated areas of Project site for storage and staging needs.
- E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
  - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
  - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    - a. Provide temporary, directional signs for construction personnel and visitors.
  - 3. Maintain and touch up signs so they are legible at all times.
- F. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

### 3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
  - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
  - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
  - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
  - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
  - 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- 3.6 MOISTURE AND MOLD CONTROL
  - A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
  - B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
    - 1. Protect porous materials from water damage.
    - 2. Protect stored and installed material from flowing or standing water.
    - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
    - 4. Remove standing water from decks.
    - 5. Keep deck openings covered or dammed.
  - C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
    - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
    - 2. Keep interior spaces reasonably clean and protected from water damage.
    - 3. Periodically collect and remove waste containing cellulose or other organic matter.
    - 4. Discard or replace water-damaged material.
    - 5. Do not install material that is wet.
    - 6. Discard and replace stored or installed material that begins to grow mold.
    - 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
  - D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
    - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
    - 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
    - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

### 3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  - At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 57 23 - TEMPORARY STORMWATER POLLUTION CONTROL

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:1. Temporary stormwater pollution controls.
- 1.2 STORMWATER POLLUTION PREVENTION PLAN
  - A. The Stormwater Pollution Prevention Plan (SWPPP) is part of the Contract Documents and is bound into this Project Manual.
- 1.3 PREINSTALLATION MEETINGS
  - A. Preinstallation Conference: Conduct conference at Project site .
- 1.4 INFORMATIONAL SUBMITTALS
  - A. Stormwater Pollution Prevention Plan (SWPP): Within 15 days of date established for commencement of the Work, submit completed SWPPP.
  - B. EPA authorization under the EPA's "2017 Construction General Permit (CGP)."
  - C. Stormwater Pollution Prevention (SWPP) Training Log: For each individual performing Work under the SWPPP.
  - D. Inspection reports.
- 1.5 QUALITY ASSURANCE
  - A. Stormwater Pollution Prevention Plan (SWPPP) Coordinator: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.
    - 1. SWPPP Coordinator shall complete and finalize the SWPPP form.
    - 2. SWPPP Coordinator shall be responsible for inspections and maintaining of all requirements of the SWPPP.
  - B. Installers: Trained as indicated in the SWPPP.
- PART 2 PRODUCTS
- 2.1 TEMPORARY STORMWATER POLLUTION CONTROLS
  - A. Provide temporary stormwater pollution controls as required by the SWPPP.

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the SWPPP.
- B. Locate stormwater pollution controls in accordance with the SWPPP.
- C. Conduct construction as required to comply with the SWPPP and that minimize possible contamination or pollution or other undesirable effects.
  - 1. Inspect, repair, and maintain SWPPP controls during construction.
    - a. Inspect all SWPPP controls not less than every seven days, and after each occurrence of a storm event, as outlined in the SWPPP.
- D. Remove SWPPP controls at completion of construction and restore and stabilize areas disturbed during construction.

END OF SECTION 01 57 23

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### SECTION 01 60 00 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Section 01 25 00 "Substitution Procedures" for requests for substitutions.

### 1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
  - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
  - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section,

provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
  - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
  - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 "Submittal Procedures."
- F. Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

## 1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

## 1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

### 1.5 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  - 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
  - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

- 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
- 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
- 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

### PART 2 - PRODUCTS

## 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  - 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
  - 4. Where products are accompanied by the term "as selected," Architect will make selection.
  - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
  - 1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
  - 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
  - 3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
  - 4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

- a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
- b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
- 5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
  - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
- 6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
  - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
- 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
  - a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
  - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

## 2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

- 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
- 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
- 3. Evidence that proposed product provides specified warranty.
- 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
- 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 33 00 "Submittal Procedures."
  - 1. Form of Approval of Submittal: As specified in Section 01 33 00 "Submittal Procedures."
  - 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

### SECTION 01 73 00 - EXECUTION

#### PART 1 - GENERAL

#### 1.1 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's portion of the Work.
  - 6. Coordination of Owner-installed products.
  - 7. Progress cleaning.
  - 8. Starting and adjusting.
  - 9. Protection of installed construction.
- B. Related Requirements:
  - 1. Section 01 10 00 "Summary" for coordination of Owner-furnished products , Ownerperformed work , Owner's separate contracts, and limits on use of Project site.
  - 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.
  - 3. Section 02 41 19 "Selective Demolition" for demolition and removal of selected portions of the building.

### 1.2 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.
- 1.3 INFORMATIONAL SUBMITTALS
  - A. Certificates: Submit certificate signed by professional engineer, certifying that location and elevation of improvements comply with requirements.
- 1.4 CLOSEOUT SUBMITTALS
  - A. Final Property Survey: Submit 1 digtal (PDF) copy showing the Work performed and record survey data.

#### 1.5 QUALITY ASSURANCE

A. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. 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. Use materials that are not considered hazardous.
- C. 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.
  - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

### 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 sitework, 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, gas service piping, and water-service piping; underground electrical services; and other utilities.
  - 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, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
  - 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. 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. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with 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 existing conditions. If discrepancies are discovered, notify Architect promptly.
- B. Engage a professional engineer experienced in laying out the Work, using the following 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: 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. 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.
- B. 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.
- C. Final Property Survey: Engage a professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by professional engineer, 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.
#### 3.5 INSTALLATION

- A. 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 <u>96 inches</u> in occupied spaces and <u>90 inches</u> in unoccupied spaces, unless otherwise indicated on Drawings.
- 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 satisfactory results as judged by Architect. 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 of type expected for Project.
- 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: 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 with manufacturer.
  - 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, as judged by Architect. 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. 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 in accordance with requirements in Section 01 10 00 "Summary."
- F. 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.

- G. 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, as judged by Architect. 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 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, 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, corner to corner of wall and edge to edge of ceiling. 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.
- H. 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 COORDINATION OF OWNER'S PORTION OF THE WORK

- A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.
  - 1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
  - 2. Refer to Section 01 10 00 "Summary" for other requirements for Owner-furnished, Contractor-installed products
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.
  - 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.

#### 3.8 PROGRESS CLEANING

- A. 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 deg F.
  - 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: 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. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."
- 3.10 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION
  - A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
  - B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
  - 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. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

### SECTION 01 77 00 - CLOSEOUT PROCEDURES

#### PART 1 - GENERAL

- 1.1 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.
  - B. Related Requirements:
    - 1. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
    - 2. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
    - 3. Section 01 79 00 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.
- 1.2 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.
- 1.3 CLOSEOUT SUBMITTALS
  - A. Certificates of Release: From authorities having jurisdiction.
  - B. Certificate of Insurance: For continuing coverage.
  - C. Field Report: For pest-control inspection.
- 1.4 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, 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 the Owner. Label with manufacturer's name and model number.
- 5. Submit testing, adjusting, and balancing records.
- 6. Submit sustainable design submittals not previously submitted.
- 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 items below that are incomplete at time of request.
  - 1. Advise Owner of pending insurance changeover requirements.
  - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  - 3. Complete startup and testing of systems and equipment.
  - 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 specified in Section 01 79 00 "Demonstration and Training."
  - 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.

## 1.5 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 in accordance with Section 01 29 00 "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.
- 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 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.

## 1.6 LIST OF INCOMPLETE ITEMS

- 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, starting with exterior areas first , listed by room or space number.
  - 2. Organize items applying to each space by major element, including categories for ceilings, 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 one of the following formats:
    - a. PDF Electronic File: Architect will return annotated file.
    - b. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

# 1.7 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. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- C. 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 .
- D. 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 8-1/2-by-11-inch paper.
- E. 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.
  - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

# PART 3 - EXECUTION

# 3.1 FINAL CLEANING

- A. 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 of rubbish, waste material, litter, and other foreign substances.
    - b. 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.
    - c. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - d. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.

- e. Vacuum and mop concrete.
- f. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
- g. 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.
- h. Remove labels that are not permanent.
- i. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- I. Clean ducts, blowers, and coils.

1) Clean HVAC system in compliance with NADCA ACR.

- m. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
- n. Clean strainers.
- o. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."
- 3.2 REPAIR OF THE WORK
  - A. Complete repair and restoration operations required by Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 77 00

### SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

#### PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
    - 1. Operation and maintenance documentation directory manuals.
    - 2. Emergency manuals.
    - 3. Systems and equipment operation manuals.
    - 4. Systems and equipment maintenance manuals.
    - 5. Product maintenance manuals.

#### 1.2 CLOSEOUT SUBMITTALS

A. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

#### 1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
  - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
  - 2. 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.

## 1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: 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: Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name and contact information for Contractor.
  - 6. Name and contact information for Construction Manager.
  - 7. Name and contact information for Architect.
  - 8. Name and contact information for Commissioning Authority.
  - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  - 10. Cross-reference to related systems in other operation and maintenance manuals.
- 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.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

#### 1.5 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
  - 1. Type of emergency.
  - 2. Emergency instructions.
  - 3. Emergency procedures.

- C. 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.
- D. 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.
- E. 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.
- 1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS
  - A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
  - B. 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. Use designations for systems and equipment indicated on Contract Documents.
    - 2. Performance and design criteria if Contractor has delegated design responsibility.
    - 3. Operating standards.
    - 4. Operating procedures.
    - 5. Operating logs.
    - 6. Wiring diagrams.
    - 7. Control diagrams.
    - 8. Piped system diagrams.
    - 9. Precautions against improper use.
    - 10. License requirements including inspection and renewal dates.
  - C. Descriptions: Include the following:
    - 1. Product name and model number. Use designations for products indicated on Contract Documents.
    - 2. Manufacturer's name.
    - 3. Equipment identification with serial number of each component.

- 4. Equipment function.
- 5. Operating characteristics.
- 6. Limiting conditions.
- 7. Performance curves.
- 8. Engineering data and tests.
- 9. Complete nomenclature and number of replacement parts.
- D. 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. Seasonal and weekend operating instructions.
  - 8. Required sequences for electric or electronic systems.
  - 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.
- 1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS
  - A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
  - B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.
  - C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
    - 1. Standard maintenance instructions and bulletins; 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.

- a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
- 3. Identification and nomenclature of parts and components.
- 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.
- H. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

### 1.8 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. 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.
- C. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.

- 3. Color, pattern, and texture.
- 4. Material and chemical composition.
- 5. 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. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. 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.
  - 1. Include procedures to follow and required notifications for warranty claims.

#### PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23

## SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

#### PART 1 - GENERAL

### 1.1 SUMMARY

- A. 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 Requirements:
  - 1. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

## 1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set(s) of marked-up record prints.
  - 2. Number of Copies: Submit copies of Record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit PDF electronic files of scanned record prints .
      - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:
      - 1) Submit PDF electronic files of scanned Record Prints and one set(s) of file prints.
      - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files and one paper copies of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories and one paper copies of each submittal.
  - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

# 1.3 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
  - 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 provide information for preparation of corresponding marked-up record prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
- b. Accurately record information in an acceptable drawing technique.
- c. Record data as soon as possible after obtaining it.
- d. Record and check the markup before enclosing concealed installations.
- e. Cross-reference record prints to corresponding photographic documentation.
- 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. Locations and depths of underground utilities.
  - d. Revisions to routing of piping and conduits.
  - e. Revisions to electrical circuitry.
  - f. Actual equipment locations.
  - g. Duct size and routing.
  - h. Locations of concealed internal utilities.
  - i. Changes made by Change Order or Construction Change Directive.
  - j. Changes made following Architect's written orders.
  - k. Details not on the original Contract Drawings.
  - I. Field records for variable and concealed conditions.
  - m. Record information on the Work that is shown only schematically.
- 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
- 4. Mark record prints 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. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
  - 1. Format: Annotated PDF electronic file with comment function enabled.
  - 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  - 3. Refer instances of uncertainty to Architect for resolution.
  - 4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
  - 1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  - 2. Format: Annotated PDF electronic file with comment function enabled.

- 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
- 4. Identification: As follows:
  - a. Project name.
  - b. Date.
  - c. Designation "PROJECT RECORD DRAWINGS."
  - d. Name of Architect.
  - e. Name of Contractor.

## 1.4 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  - 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
  - 5. Note related Change Orders , Record Product Data, and Record Drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file scanned PDF electronic file(s) of marked-up paper copy of Specifications.

# 1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders , Record Specifications, and Record Drawings where applicable.
- C. Format: Submit Record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
  - 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 39

## SECTION 01 79 00 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
  - 2. Demonstration and training video recordings.

## 1.2 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 01 78 23 "Operation and Maintenance Data."

## 1.3 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

## 1.4 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
      - b. Performance and design criteria if Contractor is delegated design responsibility.
      - c. Operating standards.
      - d. Regulatory requirements.
      - e. Equipment function.

- f. Operating characteristics.
- g. Limiting conditions.
- h. Performance curves.
- 2. Documentation: Review the following items in detail:
  - a. Emergency manuals.
  - b. Systems and equipment operation manuals.
  - c. Systems and equipment maintenance manuals.
  - d. Product maintenance manuals.
  - e. Project Record Documents.
  - f. Identification systems.
  - g. Warranties and bonds.
  - h. Maintenance service agreements and similar continuing commitments.
- 3. Emergencies: Include the following, as applicable:
  - a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
- 4. Operations: Include the following, as applicable:
  - a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - I. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
  - Troubleshooting: Include the following:
    - a. Diagnostic instructions.
    - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning.

6.

- e. Procedures for preventive maintenance.
- f. Procedures for routine maintenance.
- g. Instruction on use of special tools.
- 8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

### 1.5 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

#### 1.6 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner , through Architect, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

#### 1.7 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.

- 1. Submit video recordings on CD-ROM or thumb drive .
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
- E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 01 79 00

### SECTION 02 41 16 - STRUCTURE DEMOLITION

### PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Demolition and removal of buildings.
  - 2. Removing below-grade construction.
  - 3. Disconnecting, capping or sealing, and abandoning in-place site utilities.

## 1.2 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### 1.3 FIELD CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
  - 1. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
    - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. Hazardous materials will be removed by Owner before start of the Work.
  - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. On-site storage or sale of removed items or materials is not permitted.

#### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

## 2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 31 20 00 "Earth Moving."

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
- C. Inventory and record the condition of items to be removed and salvaged.
- 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS
  - A. Existing Utilities to Be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
    - 1. Arrange to shut off utilities with utility companies.
    - 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
    - 3. Cut off pipe or conduit a minimum of 24 inches below finished subgrade indicated on the Grading Plans. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
    - 4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

# 3.3 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 01 50 00 "Temporary Facilities and Controls."
  - 1. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

# 3.4 DEMOLITION

- A. General: Demolish indicated buildings completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
  - 2. Maintain adequate ventilation when using cutting torches.
  - 3. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
  - 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
- C. Explosives: Use of explosives is not permitted.
- D. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- E. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- F. Demolish foundation walls and other below-grade construction .
  - 1. Remove below-grade construction, including basements, foundation walls, and footings, completely .
- G. Existing Utilities: Abandon existing utilities and below-grade utility structures that are within outside footprint indicated for new construction. Abandon utilities outside this area.
- H. Hydraulic Elevator Systems: Demolish and remove elevator system, including cylinder, plunger, well assembly, steel well casing and liner, oil supply lines, and tanks.

- I. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 31 20 00 "Earth Moving."
- J. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.
- K. Promptly repair damage to adjacent buildings caused by demolition operations.

## 3.5 CLEANING

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
- B. Do not burn demolished materials.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION 02 41 16

## SECTION 03 20 00 - CONCRETE REINFORCING

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Steel reinforcement bars.
    - 2. Welded-wire reinforcement.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Each type of steel reinforcement.
  - 2. Bar supports.
  - 3. Mechanical splice couplers.
- B. Shop Drawings: Comply with ACI SP-066:
  - 1. Include placing drawings that detail fabrication, bending, and placement.
  - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
  - 1. Location of construction joints is subject to approval of the Architect.
- PART 2 PRODUCTS
- 2.1 STEEL REINFORCEMENT
  - A. Reinforcing Bars: ASTM A615/A615M, Grade 60 Grade 80, deformed.
  - B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from asdrawn steel wire into flat sheets.
- 2.2 REINFORCEMENT ACCESSORIES
  - A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
    - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
      - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

- B. Mechanical Splice Couplers: ACI 318 Type 2, same material of reinforcing bar being spliced; tension-compression type .
- C. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
  1. Finish: Plain .
- 2.3 FABRICATING REINFORCEMENT
  - A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Protection of In-Place Conditions:
  - 1. Do not cut or puncture vapor retarder.
  - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

## 3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
  - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
  - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
  - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
  - 2. Stagger splices in accordance with ACI 318.
  - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
  - 4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.
- G. Install welded-wire reinforcement in longest practicable lengths.
  - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

- For reinforcement less than W4.0 or D4.0, continuous support spacing shall not a. exceed 12 inches.
- 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
- 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
- 4. Lace overlaps with wire.
- 3.3 JOINTS
  - Construction Joints: Install so strength and appearance of concrete are not impaired, at Α. locations indicated or as approved by Architect.
    - 1. Place joints perpendicular to main reinforcement.
    - 2. Continue reinforcement across construction joints unless otherwise indicated.
    - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- 3.4 INSTALLATION TOLERANCES
  - Comply with ACI 117. Α.

END OF SECTION 03 20 00

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.
  - B. Related Requirements:
    - 1. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
    - 2. Section 03 35 43 "Polished Concrete Finishing" for concrete slab-on-grade construction that will remain exposed to view and receive a polished finish.
    - 3. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-ground.

#### 1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.
- 1.3 PREINSTALLATION MEETINGS
  - A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each of the following.
  - 1. Portland cement.
  - 2. Aggregates.
  - 3. Admixtures:
    - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
  - 4. Vapor retarders.
  - 5. Liquid floor treatments.
  - 6. Curing materials.
  - 7. Joint fillers.
- B. Design Mixtures: For each concrete mixture, include the following:
  - 1. Mixture identification.
  - 2. Minimum 28-day compressive strength.

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- 3. Maximum w/cm.
- 4. Slump limit.
- 5. Air content.
- 6. Nominal maximum aggregate size.
- 7. Intended placement method.
- 8. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Shop Drawings:
  - 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
    - a. Location of construction joints is subject to approval of the Architect / Engineer.
- 1.5 INFORMATIONAL SUBMITTALS
  - A. Material Certificates: For each of the following, signed by manufacturers:
    - 1. Cementitious materials.
    - 2. Admixtures.
    - 3. Curing compounds.
    - 4. Vapor retarders.
    - 5. Joint-filler strips.
  - B. Material Test Reports: For the following, from a qualified testing agency:
    - 1. Portland cement.
    - 2. Fly ash.
    - 3. Aggregates.
    - 4. Admixtures:
  - C. Preconstruction Test Reports: For each mix design.
  - D. Field quality-control reports.

# 1.6 QUALITY ASSURANCE

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

# 1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
  - 1. Include the following information in each test report:
    - a. Admixture dosage rates.
    - b. Slump.
    - c. Air content.

- d. Seven-day compressive strength.
- e. 28-day compressive strength.
- 1.8 DELIVERY, STORAGE, AND HANDLING
  - A. Comply with ASTM C94/C94M and ACI 301.
- 1.9 FIELD CONDITIONS
  - A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1.
  - B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.
- PART 2 PRODUCTS
- 2.1 CONCRETE, GENERAL
  - A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.
- 2.2 CONCRETE MATERIALS
  - A. Cementitious Materials:
    - 1. Portland Cement: ASTM C150/C150M, Type I/II , .
  - B. Normal-Weight Aggregates: ASTM C33/C33M, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.
    - 1. Alkali-Silica Reaction: Comply with one of the following:
      - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
      - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
      - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
    - 2. Maximum Coarse-Aggregate Size: 1 inch nominal.
    - 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
  - C. Air-Entraining Admixture: ASTM C260/C260M.
  - D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.
    - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
    - 2. Retarding Admixture: ASTM C494/C494M, Type B.

- 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
- 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
- 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
- E. Water and Water Used to Make Ice: ASTM C94/C94M, potable.
- 2.3 VAPOR RETARDERS
  - A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A, except with maximum water-vapor permeance of 0.01; not less than thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.
    - 1. <u>Manufacturers:</u> Subject to compliance with requirements, undefined:
      - a. ISI Building Products.
      - b. Stego Industries, LLC.
      - c. Tex-Trude.
      - d. W. R. Meadows, Inc.
- 2.4 CURING MATERIALS
  - A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
  - B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
    - 1. Color:
      - a. Ambient Temperature Below 50 deg F: Black.
      - b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
      - c. Ambient Temperature Above 85 deg F: White.
  - C. Water: Potable or complying with ASTM C1602/C1602M.
  - D. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

1. <a></a>
<a>

- E. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B , certified by curing compound manufacturer to not interfere with bonding of floor covering.
- F. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.
- 2.5 RELATED MATERIALS
  - A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

## 2.6 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
  - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash or Other Pozzolans: 25 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
  - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 3. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

#### 2.7 CONCRETE MIXTURES

- A. Refer to sheet S501 for specific mix designs and additional information.
- 2.8 CONCRETE MIXING
  - A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

#### PART 3 - EXECUTION

- 3.1 INSTALLATION OF EMBEDDED ITEMS
  - A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
    - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
    - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

### 3.2 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
  - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
  - 2. Face laps away from exposed direction of concrete pour.
- 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
- 4. Lap joints 6 inches minimum, or as required per manufacturer's recommendations, and seal with manufacturer's recommended tape.
- 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
- 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
- 7. Protect vapor retarder during placement of reinforcement and concrete.
  - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by <u>6 inches</u> on all sides, and sealing to vapor retarder.

# 3.3 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
  - 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
  - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
  - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

# 3.4 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
  - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
  - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
  - 1. If a section cannot be placed continuously, provide construction joints as indicated.
  - 2. Deposit concrete to avoid segregation.
  - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
    - a. Do not use vibrators to transport concrete inside forms.
    - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Do not place concrete floors and slabs in a checkerboard sequence.
  - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 3. Maintain reinforcement in position on chairs during concrete placement.
  - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 5. Level concrete, cut high areas, and fill low areas.
  - 6. Slope surfaces uniformly to drains where required.
  - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
  - 8. Do not further disturb slab surfaces before starting finishing operations.

# 3.5 FINISHING FORMED SURFACES

- A. Related Unformed Surfaces:
  - 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.

2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

# 3.6 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Trowel Finish:
  - 1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
  - 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
  - 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 4. Do not add water to concrete surface.
  - 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
  - 6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system .
  - 7. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

# 3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling In:
  - 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
  - 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
  - 3. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
  - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
  - 2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
  - 3. Minimum Compressive Strength: 4000 psi at 28 days.

- 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
- 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
- 6. Prior to pouring concrete, place and secure anchorage devices.
  - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - b. Cast anchor-bolt insert into bases.
  - c. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
  - 1. Cast-in inserts and accessories, as shown on Drawings.
  - 2. Screed, tamp, and trowel finish concrete surfaces.

# 3.8 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
  - 1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
  - 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
  - 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
  - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
  - 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
  - 3. If forms remain during curing period, moist cure after loosening forms.
  - 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
    - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
      - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
      - 2) Maintain continuity of coating and repair damage during curing period.

- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
  - 1. Begin curing immediately after finishing concrete.
  - 2. Interior Concrete Floors:
    - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
      - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
        - a) Lap edges and ends of absorptive cover not less than 12-inches.
        - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
      - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moistureretaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
        - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
        - b) Cure for not less than seven days.
      - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
        - a) Water.
        - b) Continuous water-fog spray.
    - b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
      - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
        - a) Lap edges and ends of absorptive cover not less than 12 inches.
        - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
      - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moistureretaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
        - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
        - b) Cure for not less than seven days.
      - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
        - a) Water.
        - b) Continuous water-fog spray.
    - c. Floors to Receive Polished Finish: Contractor has option of the following:

- 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
  - a) Lap edges and ends of absorptive cover not less than 12 inches.
  - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
- 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
  - a) Water.
  - b) Continuous water-fog spray.
- d. Floors to Receive Chemical Stain:
  - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
- e. Floors to Receive Urethane Flooring:
  - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
  - 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
  - 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
  - 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.
- f. Floors to Receive Curing Compound:
  - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
  - 3) Maintain continuity of coating, and repair damage during curing period.
  - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
- g. Floors to Receive Curing and Sealing Compound:
  - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
  - 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

### 3.9 TOLERANCES

A. Conform to ACI 117.

# 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
  - 1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
  - 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
  - 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
    - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
      - 1) Project name.
      - 2) Name of testing agency.
      - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
      - 4) Name of concrete manufacturer.
      - 5) Date and time of inspection, sampling, and field testing.
      - 6) Date and time of concrete placement.
      - 7) Location in Work of concrete represented by samples.
      - 8) Date and time sample was obtained.
      - 9) Truck and batch ticket numbers.
      - 10) Design compressive strength at 28 days.
      - 11) Concrete mixture designation, proportions, and materials.
      - 12) Field test results.
      - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
      - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
  - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
    - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

- 2. Slump: ASTM C143/C143M:
  - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - b. Perform additional tests when concrete consistency appears to change.
- 3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; .
  - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
- 4. Concrete Temperature: ASTM C1064/C1064M:
  - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
- 5. Compression Test Specimens: ASTM C31/C31M:
  - a. Cast and laboratory cure two sets of three 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
- 6. Compressive-Strength Tests: ASTM C39/C39M.
  - a. Test one set of three laboratory-cured specimens at seven days and one set of two specimens at 28 days.
  - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- 7. When strength of field-cured cylinders is less than 85 percent of companion laboratorycured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
- 9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- 10. Additional Tests:
  - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
  - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
    - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.
- 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

- 1. Specified Overall Value:
  - a. Exposed polished concrete areas: Ff = 35 / Fl = 25
  - b. All other areas: Ff = 25 / Fl = 20
- 2. Minimum Local Value:
  - a. Exposed polished concrete areas: Ff = 24 / Fl = 17
  - b. All other areas: Ff = 17 / Fl = 14

# 3.11 PROTECTION

- A. Protect concrete surfaces as follows:
  - 1. Protect from petroleum stains.
  - 2. Diaper hydraulic equipment used over concrete surfaces.
  - 3. Prohibit vehicles from interior concrete slabs.
  - 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
  - 5. Prohibit placement of steel items on concrete surfaces.
  - 6. Prohibit use of acids or acidic detergents over concrete surfaces.
  - 7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
  - 8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 03 30 00

SECTION 03 35 43 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:1. Polished concrete finishing , including staining .
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Samples: For each type of product requiring color selection.

# 1.3 QUALITY ASSURANCE

- A. Field Sample Panels: After approval of samples, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches minimum, to demonstrate the expected range of finish, color, and appearance variations.
  - 1. Locate panels as indicated or, if not indicated, as directed by Architect.
  - 2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
  - 3. Demolish and remove field sample panels when directed.

## PART 2 - PRODUCTS

### 2.1 STAIN MATERIALS

- A. Penetrating Stain: Water-based, acrylic latex, penetrating stain with colorfast pigments.
  - 1. <u>Manufacturers</u>: 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. Americrete, Inc.
    - b. AmeriPolish.
    - c. Bomanite Co.
    - d. Bon Tool Co.
    - e. Brickform; a division of Solomon Colors.
    - f. Butterfield Color, Inc.
    - g. Duckback Products.
    - h. H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.
    - i. Scofield, a Business Unit of Sika Corporation.
    - j. Super Stone, Inc.

# 2.2 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
  - 1. <u>Manufacturers</u>: 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. Advanced Floor Products.
    - b. AmeriPolish.
    - c. ARDEX Americas.
    - d. AWRC Corporation.
    - e. Euclid Chemical Company (The); an RPM company.
    - f. H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.
    - g. Laticrete International, Inc.
    - h. MAPEI Corporation.
    - i. Moxie International.
    - j. NewLook International, Inc.
    - k. Nox-Crete Products Group.
    - I. PROSOCO, Inc.
    - m. QuestMark.
    - n. Vexcon Chemicals Inc.

# PART 3 - EXECUTION

# 3.1 POLISHING

- A. Polish: Level 3: High sheen, 800 grit .
- B. Apply polished concrete finish system to cured and prepared slabs.
  - 1. Machine grind floor surfaces to receive polished finishes level and smooth.
  - 2. Apply reactive stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
  - 3. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
  - 4. Apply penetrating stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
  - 5. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
  - 6. Control and dispose of waste products produced by grinding and polishing operations.
  - 7. Neutralize and clean polished floor surfaces.

# 3.2 STAINING

A. Newly placed concrete shall be at least 30 days old before staining.

- B. Prepare surfaces according to manufacturer's written instructions and as follows:
  - Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
     a. Do not use acidic solutions to clean surfaces.
  - 2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by grinding, sanding, or abrasive blasting. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
  - 3. Apply acidic solution to dampened concrete surfaces, scrubbing with uncolored, acidresistant nylon-bristle brushes until bubbling stops and concrete surface has texture of 120-grit sandpaper. Do not allow solution to dry on concrete surfaces. Rinse until water is clear. Control, collect, and legally dispose of runoff.
  - 4. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F710 to ensure pH is between 7 and 8
- C. Allow concrete surface to dry before applying stain. Verify readiness of concrete to receive stain according to ASTM D4263 by tightly taping 18-by-18-inch, 4-mil- thick polyethylene sheet to a representative area of concrete surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.
- D. Penetrating Stain: Apply penetrating stain to concrete surfaces according to manufacturer's written instructions and as follows:
  - 1. Apply first coat of stain to dry, clean surfaces by airless sprayer or by high-volume, low-pressure sprayer.
  - 2. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
  - 3. Rinse until water is clear. Control, collect, and legally dispose of runoff.

END OF SECTION 03 35 43

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### SECTION 04 26 13 - MASONRY VENEER

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Clay face brick.
  - B. Products Installed but Not Furnished under This Section:
    - 1. Steel lintels in masonry veneer.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.

### 1.3 FIELD CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
  - Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

### PART 2 - PRODUCTS

- 2.1 UNIT MASONRY, GENERAL
  - A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
  - B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.
- 2.2 BRICK
  - A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
    - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

- 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: Facing brick complying with ASTM C216.
  - 1. BricK: Brapmton Architectural Series, Graphite Modular (Farmersburg, Indiana Plant)
  - 2. Grade SW .
  - 3. Type FBX .
  - 4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67.
  - 5. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
  - 6. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
  - 7. Color and Texture: As selected by Architect.

# 2.3 MORTAR MATERIALS

- A. Masonry Cement: ASTM C91/C91M.
  - 1. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide Spec Mix Masonry Cement and Sand Brick and Block Masonry Mortar or comparable product.
- B. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
- C. Aggregate for Mortar: ASTM C144.
  - 1. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- D. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- E. Water: Potable.

# 2.4 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
  - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
  - 2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
- C. Adjustable Masonry-Veneer Anchors:

- 1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
- 2. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
- 3. Fabricate wire connector sections from 0.187-inch- diameter, hot-dip galvanized, carbon-steel wire.
- 4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonryveneer anchors specified.
- 5. Single screw veneer tie for metal stud construction with a dual-diameter barrel with factory-installed EPDM washers to seal both the face of the insulation and the air/vapor barrier.
  - a. Basis of Design: 2 Seal Tie by Hohman and Barnard, Inc.

# 2.5 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
  - 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
  - Fabricate continuous flashings in sections <u>96 inches</u> long minimum, but not exceeding <u>12 feet</u>. Provide splice plates at joints of formed, smooth metal flashing.
  - 3. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
  - 4. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
  - 5. Fabricate metal end dams, inside corners, and outside corners from 26 ga type 304 stainless steel.
- B. Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
- C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

# 2.6 MISCELLANEOUS MASONRY ACCESSORIES

- A. Self-adhering stainless steel fabric flashing with removable release liner over factory-applied adhesive laminated to a Class A material consisting of a layer of polymeric fabric with a single sheet of Type 304 stainless steel bonded to one side.
  - 1. Basis of Design Product: Hohman & Barnard, Inc., Mighty-Flash SA Self-Adhering Stainless Steel Fabric Flashing.
- B. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

MASONRY VENEER 04 26 13 - 4 arcDESIGN, PC

- C. Weep/Vent Products: Use the following unless otherwise indicated:
  - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
  - 2. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
  - 1. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide <u>Hohmann &</u> <u>Barnard, Inc</u>; Mortar Trap or comparable product by one of the following:
    - a. Advanced Building Products Inc.
    - b. CavClear/Archovations, Inc.
    - c. Heckmann Building Products, Inc.
    - d. Mortar Net Solutions.
    - e. Wire-Bond.
  - 2. Configuration: Provide one of the following:
    - a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.

# 2.7 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
  - 1. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide <u>PROSOCO</u>, <u>Inc</u>; Sure Klean<sup>®</sup> 600 or comparable product by one of the following:
    - a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
    - b. EaCo Chem, Inc.

# 2.8 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Use masonry cement mortar unless otherwise indicated.
  - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Use Type N unless another type is indicated.
- C. Pigmented Mortar: Use colored cement product.
  - 1. Pigments shall not exceed 10 percent of portland cement by weight.

- 2. Pigments shall not exceed 5 percent of masonry cement by weight.
- 3. Application: Use pigmented mortar for exposed mortar joints.

# PART 3 - EXECUTION

# 3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

# 3.2 TOLERANCES

- A. Dimensions and Locations of Elements:
  - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
  - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
  - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
  - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
  - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
  - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
  - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
  - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
- C. Joints:
  - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
  - 2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

### MASONRY VENEER

#### 3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

### 3.4 MORTAR BEDDING AND JOINTING

- A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

### 3.5 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
  - 1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
  - 2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
  - 3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
- B. Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.

### 3.6 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
  - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal

penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

- 2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
- 3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
- 4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
- C. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
  - 1. Use specified weep/vent products to form weep holes.
  - 2. Space weep holes 24 inches o.c. unless otherwise indicated.
- D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
  - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.
- 3.7 REPAIRING, POINTING, AND CLEANING
  - A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
  - B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
    - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
    - 2. Protect adjacent stone and nonmasonry surfaces from contact with cleaner.
    - 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
    - 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
    - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

# 3.8 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soilcontaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  - 1. Do not dispose of masonry waste as fill within <u>18 inches</u> of finished grade.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 26 13

SECTION 05 31 00 - STEEL DECKING

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:1. Roof deck.
- 1.2 ACTION SUBMITTALS
  - A. Product Data:1. Roof deck.
- 1.3 DELIVERY, STORAGE, AND HANDLING
  - A. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
- PART 2 PRODUCTS
- 2.1 PERFORMANCE REQUIREMENTS
  - A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.
- 2.2 ROOF DECK
  - A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:
    - 1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating.
    - 2. Deck Profile: Type NR, narrow rib.
    - 3. Profile Depth: As indicated .
    - 4. Design Uncoated-Steel Thickness: 0.0295 inch .
    - 5. Span Condition: Simple span .
    - 6. Side Laps: Overlapped .
- 2.3 ACCESSORIES
  - A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
  - B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

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- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

### PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
  - A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.
  - B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
  - C. Locate deck bundles to prevent overloading of supporting members.
  - D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
  - E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
  - F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
  - G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
  - H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
  - I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

# 3.2 INSTALLATION OF ROOF DECK

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
  - 1. Weld Diameter: 5/8 inch , nominal.
  - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 18 inches apart, maximum .
  - 3. Weld Washers: Install weld washers at each weld location.

- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches, and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Butted .
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
  - 1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.
- 3.3 REPAIR
  - A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.
  - B. Repair Painting:
    - 1. Wire brush and clean rust spots, welds, and abraded areas on top surface of primepainted deck immediately after installation, and apply repair paint.
    - 2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
    - 3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
    - 4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

END OF SECTION 05 31 00

# SECTION 05 40 00 - COLD-FORMED METAL FRAMING

## PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Exterior non-load-bearing wall framing.
    - 2. Interior non-load-bearing wall framing.
      - a. Interior Locations: East Wall of Hall Wall to Deck

# 1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Cold-formed steel framing materials.
  - 2. Exterior non-load-bearing wall framing.
  - 3. Interior non-load-bearing wall framing.
  - 4. Vertical deflection clips.
  - 5. Single deflection track.
  - 6. Double deflection track.
  - 7. Post-installed anchors.
  - 8. Power-actuated anchors.
- B. Shop Drawings:
  - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
  - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For cold-formed steel framing.
  - 1. Include structural analysis data signed and sealed by the qualified professional engineer licensed in the State of Indiana responsible for their preparation.

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. <u>Manufacturers:</u> 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. AllSteel & Gypsum Products, Inc.
  - 2. ClarkDietrich.
  - 3. MarinoWARE.
  - 4. Telling Industries.
  - 5. The Steel Network, Inc.

# 2.2 PERFORMANCE REQUIREMENTS

- A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
  - 1. Wall Studs: AISI S211.
  - 2. Headers: AISI S212.
  - 3. Lateral Design: AISI S213.
- 2.3 COLD-FORMED STEEL FRAMING MATERIALS
  - A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
    - 1. Grade: ST50H As required by structural performance .
    - 2. Coating: G60 , A60 , AZ50 , or GF30 .
  - B. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
    - 1. Grade: As required by structural performance .
    - 2. Coating: G60.
- 2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING
  - A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
    - 1. Minimum Base-Metal Thickness: 0.0428 inch .
    - 2. Flange Width: As required by design. .
    - 3. Section Properties: As required by design. .
  - B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.
  - C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
    - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
      - a. AllSteel & Gypsum Products, Inc.
      - b. ClarkDietrich.
      - c. MarinoWARE.
      - d. The Steel Network, Inc.
  - D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

## 2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0329 inch .
  - 2. Flange Width: As required by design. .
  - 3. Section Properties: As required by design. .
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.
- C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
  - 1. <u>Manufacturers</u>: 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. ClarkDietrich.
    - b. MarinoWARE.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

### 2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.
- 2.7 ANCHORS, CLIPS, AND FASTENERS
  - A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
  - B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.
  - C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
    - 1. Uses: Securing cold-formed steel framing to structure.
    - 2. Type: Torque-controlled expansion anchor or adhesive anchor.

- 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
- 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- 2.8 MISCELLANEOUS MATERIALS
  - A. Galvanizing Repair Paint: ASTM A780/A780M or SSPC-Paint 20.

# PART 3 - EXECUTION

- 3.1 PREPARATION
  - A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- 3.2 INSTALLATION, GENERAL
  - A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
  - B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
  - C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
  - E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
  - F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

- G. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- 3.3 INSTALLATION OF EXTERIOR NON-LOAD-BEARING WALL FRAMING
  - A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
  - B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
    - 1. Stud Spacing: As required by design but not more that 16 inches .
  - C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
  - D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
    - 1. Install single deep-leg deflection tracks and anchor to building structure.
    - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
    - 3. Connect vertical deflection clips to infill studs and anchor to building structure.
    - 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
  - E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
    - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
    - 2. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
  - F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
    - 1. Install solid blocking at centers indicated on Shop Drawings.
  - G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- 3.4 INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING
  - A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

- Β. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
  - Stud Spacing: As required by design but not more that 24 inches. 1.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
  - 1. Install single deep-leg deflection tracks and anchor to building structure.
  - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
  - 3. Connect vertical deflection clips to studs and anchor to building structure.
  - 4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings E. but not more than 48 inches apart. Fasten at each stud intersection.
  - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
  - 2. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wallframing system.

#### 3.5 INSTALLATION TOLERANCES

- Install cold-formed steel framing level, plumb, and true to line to a maximum allowable Α. tolerance variation of 1/8 inch in 10 feet and as follows:
  - Space individual framing members no more than plus or minus 1/8 inch from plan 1. location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

#### 3.6 REPAIRS

Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and Α. installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

END OF SECTION 05 40 00

project.(13619)

## SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Miscellaneous steel framing and supports.
    - 2. Metal ladders.
    - 3. Ladder safety cages.
    - 4. Metal bollards.

# 1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Fasteners.
  - 2. Slotted channel framing.
  - 3. Manufactured metal ladders.
  - 4. Ladder safety cages.
  - 5. Metal bollards.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Delegated-Design Submittal: For ladders , including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

### PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
  - A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders .
- 2.2 METALS
  - A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
  - B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
  - C. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
  - D. Rolled-Stainless Steel Floor Plate: ASTM A793.

- E. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
  - 2. Material: Galvanized steel, ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.

# 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide stainless steel fasteners for exterior use and zincplated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless steel fasteners for fastening aluminum stainless steel or nickel silver.
  - 2. Provide bronze fasteners for fastening bronze.
- B. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- C. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.
- 2.4 MISCELLANEOUS MATERIALS
  - A. Shop Primers: Provide primers that comply with
- 2.5 FABRICATION, GENERAL
  - A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
  - B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
  - C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
  - D. Form exposed work with accurate angles and surfaces and straight edges.
  - E. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches from ends and corners of units and 24 inches o.c.

# 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- B. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
  - 1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.
- C. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

# 2.7 METAL LADDERS

- A. General:
  - 1. Comply with ANSI A14.3.
- B. Steel Ladders:
  - 1. Space siderails 18 inches apart unless otherwise indicated.
  - 2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
  - 3. Rungs: 1-inch- square, steel bars.
  - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
  - 5. Provide nonslip surfaces on top of each rung.
  - 6. Prime ladders, including brackets and fasteners, with zinc-rich primer.

## 2.8 LADDER SAFETY CAGES

- A. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless steel fasteners.
- B. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.
- C. Galvanize ladder safety cages, including brackets and fasteners.
  1. Prime ladder safety cages, including brackets and fasteners, with zinc-rich primer.

# 2.9 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe .
  1. Cap bollards with 1/4-inch- thick steel.
- B. Prime steel bollards with zinc-rich primer.
- 2.10 GENERAL FINISH REQUIREMENTS
  - A. Finish metal fabrications after assembly.
- 2.11 STEEL AND IRON FINISHES
  - A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
    - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
  - B. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
    1. Shop prime with unless indicated.
  - C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

## PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
  - A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- 3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS
  - A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
  - B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.
  - C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
- 3.3 INSTALLATION OF METAL BOLLARDS
  - A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
  - B. Anchor bollards in concrete in formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with shrinkageresistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
  - C. Fill bollards solidly with concrete, mounding top surface to shed water.

#### INSTALLATION OF BEARING AND LEVELING PLATES 3.4

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- Β. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

#### 3.5 REPAIRS

Α. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

## SECTION 05 52 13 - PIPE AND TUBE RAILINGS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Steel railings.
  - 2. Railing gates at the level of exit discharge.

## 1.2 ACTION SUBMITTALS

- A. Product Data:
  - 1. Manufacturer's product lines of mechanically connected railings.
  - 2. Handrail brackets.
  - 3. Shop primer.
  - 4. Intermediate coats and topcoats.
  - 5. Bituminous paint.
  - 6. Nonshrink, nonmetallic grout.
  - 7. Anchoring cement.
  - 8. Metal finishes.
  - 9. Paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- 1.3 INFORMATIONAL SUBMITTALS
- 1.4 QUALITY ASSURANCE
- PART 2 PRODUCTS
- 2.1 PERFORMANCE REQUIREMENTS
  - A. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
    - 1. Handrails and Top Rails of Guards:
      - a. Uniform load of 50 lbf/ ft. applied in any direction.
      - b. Concentrated load of 200 lbf applied in any direction.
      - c. Uniform and concentrated loads need not be assumed to act concurrently.
    - 2. Infill of Guards:
      - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
      - b. Infill load and other loads need not be assumed to act concurrently.
# 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
  - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

# 2.3 STEEL RAILINGS

- A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.
- B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.

# 2.4 FASTENERS

- A. Fastener Materials:
  - 1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941/ASTM F1941M, Class Fe/Zn 5 for zinc coating.
  - 2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
- B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
  - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

## 2.5 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast iron center of handrail 2-1/2 inches from wall.
- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Shop Primers: Provide primers that comply with Section 09 91 23 "Interior Painting."

- F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- G. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- H. Intermediate Coats and Topcoats: Provide products that comply with Section 09 91 23 "Interior Painting."
- I. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- J. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
- K. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.
- L. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- M. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
- 2.6 FABRICATION
  - A. Cut, drill, and punch metals cleanly and accurately.
    - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
    - 2. Remove sharp or rough areas on exposed surfaces.
  - B. Form work true to line and level with accurate angles and surfaces.
  - C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
    - 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 flux immediately.
    - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint .
  - D. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  - E. Form changes in direction as follows:

- 1. As detailed.
- F. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- G. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
  - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crushresistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- J. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
  - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
  - 2. Coordinate anchorage devices with supporting structure.
- 2.7 STEEL AND IRON FINISHES
  - A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
  - B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3.
  - C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
    - 1. Shop prime uncoated railings with universal shop primer unless zinc-rich primer is indicated.
    - 2. Do not apply primer to galvanized surfaces.
  - D. Shop-Painted Finish: Comply with Section 09 91 13 "Exterior Painting."
    - 1. Color: Match Architect's sample .
- PART 3 EXECUTION
- 3.1 INSTALLATION, GENERAL
  - A. Perform cutting, drilling, and fitting required for installing railings.
    - 1. Fit exposed connections together to form tight, hairline joints.

- 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
- 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
- 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
- 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
- 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

# 3.2 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

# 3.3 ATTACHING RAILINGS

- A. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
- B. Secure wall brackets and railing end flanges to building construction as follows:
  - 1. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
- C. Install railing gates level, plumb, and secure for full opening without interference.
- D. Touchup Painting:
  - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

## 3.4 CLEANING

- A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

# END OF SECTION 05 52 13

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Wood blocking , cants, and nailers.
    - 2. Wood furring.
    - 3. Plywood backing panels.

## PART 2 - PRODUCTS

- 2.1 WOOD PRODUCTS, GENERAL
  - A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
    - 1. Factory mark each piece of lumber with grade stamp of grading agency.
    - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece .
    - 3. Dress lumber, S4S, unless otherwise indicated.
  - B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.
- 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS
  - A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
    - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
  - B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
  - C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
  - D. Application: Treat items indicated on Drawings, and the following:
    - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
    - 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.

# 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flamespread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Exterior Type: Treated materials shall comply with requirements specified above for fireretardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
  - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  - 3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- D. Application: Treat items indicated on Drawings, and the following:
  - 1. Framing (WOOD DECKING) for raised platforms.
  - 2. Concealed blocking.
  - 3. Plywood backing panels.
- 2.4 MISCELLANEOUS LUMBER
  - A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
    - 1. Blocking.
    - 2. Nailers.
    - 3. Cants.
  - B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any species.
  - C. Concealed Boards: 19 percent maximum moisture content of the following species and grades:
     1. Mixed southern pine or southern pine, No. 3 grade; SPIB.
- 2.5 PLYWOOD BACKING PANELS
  - A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C , fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Do not splice structural members between supports unless otherwise indicated.
- D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- E. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 2. ICC-ES evaluation report for fastener.

## 3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

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#### SECTION 06 16 00 - SHEATHING

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Wall sheathing.
    - 2. Subflooring.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of process and factory-fabricated product.

#### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

#### 2.2 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
  - 2. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
  - 3. Design Value Adjustment Factors: Treated lumber plywood is to be tested in accordance with ASTM D5516 and design value adjustment factors are to be calculated in accordance with ASTM D6305. Span ratings after treatment are to be not less than span ratings specified.

- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all plywood unless otherwise indicated.
- 2.3 WALL SHEATHING
  - A. Glass-Mat Gypsum Sheathing, Walls: ASTM C1177/C1177M.
    - 1. <u>Manufacturers</u>: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - a. Certainteed; SAINT-GOBAIN.
      - b. National Gypsum Company.
      - c. USG Corporation.
    - 2. Type and Thickness: Type X, 5/8 inch thick.
- 2.4 SUBFLOORING AND UNDERLAYMENT
  - A. Plywood Subflooring: Either DOC PS 1 or DOC PS 2, single-floor panels.
- 2.5 FASTENERS
  - A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
    - 1. For sheathing, provide fasteners of Type 304 stainless steel.

## PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
  - A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
  - B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
  - C. Securely attach to substrate by fastening as indicated, complying with the following:
    - 1. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
    - 2. ICC-ES evaluation report for fastener.

# 3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

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- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Subflooring:
    - a. Screw to cold-formed metal framing.
    - b. Space panels 1/8 inch apart at edges and ends.
    - 2. Underlayment:
      - a. Space panels 1/32 inch apart at edges and ends.
      - b. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.
- 3.3 GYPSUM SHEATHING INSTALLATION
  - A. Comply with GA-253 and with manufacturer's written instructions.
    - 1. Fasten gypsum sheathing to wood framing with screws.
    - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
    - 3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
    - 4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
  - B. Seal sheathing joints according to sheathing manufacturer's written instructions.
    - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
    - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 16 00

SECTION 06 20 23 - INTERIOR FINISH CARPENTRY

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Interior trim.
    - 2. Shelving and clothes rods.

# 1.2 DEFINITIONS

- A. MDF: Medium-density fiberboard.
- B. MDO: Plywood with a medium-density overlay on the face.

# PART 2 - PRODUCTS

- 2.1 MATERIALS, GENERAL
  - A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
    - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - B. Softwood Plywood: DOC PS 1.
  - C. Hardboard: ANSI A135.4.
  - D. MDF: ANSI A208.2, Grade 130 .
  - E. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

# 2.2 INTERIOR TRIM

- A. Hardwood Lumber Trim for Opaque Finish (Painted Finish):
  - 1. Species and Grade:
    - a. Poplar, Prime.
  - 2. Maximum Moisture Content for Hardwoods: 10 percent.
  - 3. Finger Jointing: Not allowed.
  - 4. Face Surface: Surfaced (smooth).
- 2.3 SHELVING AND CLOTHES RODS
  - A. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.

- 1. Basis of Design: Knape and Vogt, Closet-Pro Shelf and Rod Bracket with Slide-Thru, Brushed Nickel Finish
- B. Metal Clothes Rods: 1-5/16-inch- diameter, steel tube, 22 gauge thick walls .
  - 1. Basis of Design: Knape and Vogt, Claset -Pro HD, 1-5/16" Dia. w/ closet pole end caps, Brushed Nickel Finish
- C. Shelf Board:
  - 1. Basis of Design: 14" deep shelf to be provided by casework manufacturer in plastic laminate finish indicated on drawings.
- 2.4 MISCELLANEOUS MATERIALS
  - A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- PART 3 EXECUTION
- 3.1 PREPARATION
  - A. Clean substrates of projections and substances detrimental to application.
  - B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.
- 3.2 INSTALLATION, GENERAL
  - A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
    - 1. Use concealed shims where necessary for alignment.
    - 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
    - 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
    - 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
    - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

# 3.3 INSTALLATION OF STANDING AND RUNNING TRIM

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.
  - 1. Do not use pieces less than 24 inches long, except where necessary.
  - 2. Stagger joints in adjacent and related standing and running trim.

- 3. Cope at returns, miter at outside corners, and cope at inside corners to produce tightfitting joints with full-surface contact throughout length of joint.
- 4. Use scarf joints for end-to-end joints.
- 5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
- 6. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
- 7. Install trim after gypsum-board joint finishing operations are completed.
- 8. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
- 9. Fasten to prevent movement or warping.
- 10. Countersink fastener heads on exposed carpentry work and fill holes.

# 3.4 INSTALLATION OF SHELVING AND CLOTHES RODS

- A. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- B. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled.
  - 1. Install shelves, fully seated on cleats, brackets, and supports.
  - 2. Fasten shelves to cleats with finish nails or trim screws, set flush.
  - 3. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

END OF SECTION 06 20 23

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#### SECTION 06 64 00 - PLASTIC PANELING

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. Plastic sheet wall paneling (FRP).

#### 1.3 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.
- 2.2 PLASTIC SHEET PANELING
  - A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319. Panels shall be USDA accepted for incidental food contact.
    - Basis-of-Design Product: Subject to compliance with requirements, provide Crane Composites, Inc.; GLASBORD series or comparable product by one of the following:

       Marlite.
    - 2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
      - a. Flame-Spread Index: 200 or less.
      - b. Smoke-Developed Index: 450 or less.
    - 3. Nominal Thickness: Not less than 0.09 inch .
    - 4. Wall Panel Size: 4 ft. by 10 ft. .
    - 5. Surface Finish: Embossed pebble texture .
    - 6. Scratch Resistance, ASTM D2583, Barcol Hardness: 50.
    - 7. Impact Strength, ASTM D5420: 100 in-lb, showing no visible damage on finish side.
    - 8. Color: As indicated on Drawings .

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- 2.3 ACCESSORIES
  - A. Moldings: PVC pattern-matched to panel .
  - B. Adhesive: As recommended by plastic paneling manufacturer.
  - C. Sealant: Urethane seam sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."

## PART 3 - EXECUTION

- 3.1 EXAMINATION
  - A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
    - 1. Corners: Plumb and straight.
    - 2. Surfaces: Smooth, sound, and uniform.
    - 3. Nails or Screw Fasteners: Countersunk.
    - 4. Joints and Cracks: Filled flush and smooth with adjoining surfaces.
  - B. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 PREPARATION

- A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- C. Condition panels by unpacking and placing in installation space before installation in accordance with manufacturer's written recommendations.
- D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels .
  - 1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
  - 2. Locate trim accessories to allow clearance at panel edges in accordance with manufacturer's written instructions.

## 3.3 INSTALLATION

- A. Install plastic paneling in accordance with manufacturer's written instructions.
  - 1. Do all cutting with carbide-tipped saw blades or drill bits, or cut with snips.
  - 2. Install panels plumb, level, square, flat, and in proper alignment.
  - 3. Install panels to be water resistant and washable.
  - 4. Install panels with manufacturer's recommended gap for panel field and corner joints.
- B. Install panels in a full spread of adhesive.

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- C. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- D. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

END OF SECTION 06 64 00

# SECTION 07 21 00 - THERMAL INSULATION

# PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Extruded polystyrene foam-plastic board insulation.
    - 2. Glass-fiber blanket insulation.
    - 3. Spray Foam Insulation for Sealing, Detailing, and Miscellaneous voids.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For the following:
    - 1. Extruded polystyrene foam-plastic board insulation.
    - 2. Glass-fiber blanket insulation.

## PART 2 - PRODUCTS

## 2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type IV : ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
  - 1. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide <u>DuPont de</u> <u>Nemours, Inc.</u>; Styrofoam<sup>™</sup> Brand Ultra SL Extruded Polystyrene (XPS) Foam Insulation<sup>™</sup> or comparable product by one of the following:
    - a. Dow Chemical Company (The).
    - b. Owens Corning.
  - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
  - 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
  - 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
  - 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
  - 6. R-Value: R 5.6 per one inch or R11.2 for two-inch thick boards.
- B. Extruded Polystyrene Board Insulation, Type VI : ASTM C578, Type VI, 40-psi minimum compressive strength
  - 1. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide <u>DuPont de</u> <u>Nemours, Inc.</u>; Styrofoam<sup>™</sup> Brand Highload 40 Extruded Polystyrene Foam Insulation or comparable product by one of the following:
    - a. Dow Chemical Company (The).
    - b. Owens Corning.
  - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
  - 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
  - 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

5. R-Value: R-5 per inch.

# 2.2 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced : ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
  - 1. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide <u>Knauf</u> <u>Insulation</u>; or comparable product by one of the following:
    - a. CertainTeed Corporation.
    - b. CertainTeed Insulation.
    - c. Johns Manville; a Berkshire Hathaway company.
    - d. Owens Corning.
  - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
  - 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
  - 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

# 2.3 ACCESSORIES

- A. Insulation for Parapets and Miscellaneous Voids:
  - 1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
- B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.

# PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
  - A. Comply with insulation manufacturer's written instructions applicable to products and applications.
  - B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
  - C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
  - D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
  - E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

# 3.2 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

- 1. Extend vertical insulation to the top of trench footing unless noted otherwise.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
  - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

#### 3.3 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

## 3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
  - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

# END OF SECTION 07 21 00

SECTION 07 27 13 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section includes self-adhering, vapor-retarding, modified bituminous sheet air barriers.
- 1.2 PREINSTALLATION MEETINGS
  - A. Preinstallation Conference: Conduct conference at Project site .
- 1.3 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
- 1.4 QUALITY ASSURANCE
  - A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- PART 2 PRODUCTS
- 2.1 PERFORMANCE REQUIREMENTS
  - A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
  - B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. , when tested according to ASTM E 2357.
- 2.2 SELF-ADHERING SHEET AIR BARRIER
  - A. Modified Bituminous Sheet: 40-mil- thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits.
    - 1. <u>Products:</u> Subject to compliance with requirements, provide one of the following:
      - a. Carlisle Coatings & Waterproofing Inc; CCW-705
      - b. GCP Applied Technologies Inc.; Perm-A-Barrier High Temperature Wall Membrane
      - c. Henry Company; Blueskin SA
      - d. Polyguard Products, Inc.; Polyguard 400 Sheet Air Barrier
      - e. Soprema, Inc.; Sopraseal Stick 1100T.

- f. Tremco Incorporated; ExoAir 110/110LT
- g. W.R. Meadows, Inc; Air-Shield
- 2. Physical and Performance Properties:
  - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
  - b. Tensile Strength: Minimum 250 psi ; ASTM D 412, Die C.
  - c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
  - d. Puncture Resistance: Minimum 40 lbf ; ASTM E 154/E 154M.
  - e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 70 deg F; ASTM D 570.
  - f. Vapor Permeance: Maximum 0.1 perm) ; ASTM E 96/E 96M, Desiccant Method.
  - g. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D 4541 as modified by ABAA.
  - h. UV Resistance: Can be exposed to sunlight for 60 days according to manufacturer's written instructions.

# 2.3 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.
- C. HIGH PERFORMANCE SILL SEALER
  - 1. 3/8" closed cell foam with three adhesive membrane areas for sealing off the cold joint between the foundation and construction framing and providing a transition seal between the under-slab vapor barrier and the the sheet air barrier applied to exterior walls.
    - a. Basis of Design: Protecto Wrap Triple Guard Energy Sill Sealer
  - 2. Locations: Provide at all exterior (metal stud) wall locations.

# PART 3 - EXECUTION

## 3.1 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

- C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- F. Bridge isolation joints expansion joints and discontinuous wall-to-wall, deck-to-wall, and deckto-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

# 3.2 INSTALLATION

- A. Install materials according to air-barrier manufacturer's written instructions and details and according to recommendations in ASTM D 6135 to form a seal with adjacent construction and ensure continuity of air and water barrier.
  - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install selfadhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F.
  - 2. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
  - 1. Apply sheets in a shingled manner to shed water.
  - 2. Roll sheets firmly to enhance adhesion to substrate.
- D. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
- E. Connect and seal exterior wall air-barrier sheet continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

- G. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.
- H. Do not cover air barrier until it has been tested and inspected by testing agency.
- I. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.
- 3.3 FIELD QUALITY CONTROL
  - A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
  - B. Tests: As determined by testing agency from among the following tests:
    - 1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers .
  - C. Air barriers will be considered defective if they do not pass tests and inspections.
    - 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
    - 2. Remove and replace deficient air-barrier components for retesting as specified above.
  - D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
  - E. Prepare test and inspection reports.
- 3.4 CLEANING AND PROTECTION
  - A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

END OF SECTION 07 27 13

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## SECTION 07 42 13.23 - METAL COMPOSITE MATERIAL WALL PANELS

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 metal composite material wall panels.
- 1.3 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
    - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
  - B. Shop Drawings:
    - 1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
    - 2. Accessories: Include details of the flashing, trim, and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
  - C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
    - 1. Metal Composite Material Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories.
- 1.4 INFORMATIONAL SUBMITTALS
  - A. Qualification Data: For Installer.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Maintenance Data: For metal composite material panels to include in maintenance manuals.
- 1.6 QUALITY ASSURANCE
  - A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

- 1.7 DELIVERY, STORAGE, AND HANDLING
  - A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
  - B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
  - C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.
  - D. Retain strippable protective covering on metal composite material panels during installation.

# 1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

# 1.9 COORDINATION

A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

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- 2.1 PERFORMANCE REQUIREMENTS
  - A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:
    - 1. Wind Loads: As indicated on Drawings.
    - 2. Other Design Loads: As indicated on Drawings .
    - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
  - B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
    - 1. Test-Pressure Difference: 6.24 lbf/sq. ft..
  - C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
    - 1. Test-Pressure Difference: 6.24 lbf/sq. ft..
  - D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
    - 1. Temperature Change (Range): 120 deg F , ambient; 180 deg F , material surfaces .
  - E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
  - F. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.
- 2.2 METAL COMPOSITE MATERIAL WALL PANELS
  - A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components and accessories required for weathertight system.
    - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Citadel Architectural Products, Inc. Envelope 2000 RS or a comparable product by one of the following:
      - a. Alcoa Architectural Products (USA).
      - b. Alcotex Inc.
      - c. ALPOLIC Materials; Mitsubishi Plastics Composites America.
      - d. ALUCOBOND; 3A Composites USA, Inc.
      - e. CENTRIA Architectural Systems.
      - f. Sobotec, Ltd. .

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- B. Aluminum-Faced Composite Wall Panels : Formed with 0.020-inch- thick, coil-coated aluminum sheet facings.
  - 1. Panel Thickness: 0.236 inch .
  - 2. Core: Standard .
  - 3. Exterior Finish: Two-coat fluoropolymer .
    - a. Color: Custom Color: LiUNA Orange .
- C. Attachment Assembly Components: Formed from material compatible with panel facing.
- D. Attachment Assembly: Rainscreen principle system .
- 2.3 MISCELLANEOUS MATERIALS
  - A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.
  - B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
  - C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
  - D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
  - E. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.
- 2.4 FABRICATION
  - A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

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- B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flatlock seams. Tin edges to be seamed, form seams, and solder.
  - 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
  - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

# 2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:
  - 1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 2. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 3. Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare,

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pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- 4. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- 5. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

# PART 3 - EXECUTION

- 3.1 EXAMINATION
  - A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
    - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
    - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
      - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
  - B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.
  - C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

# 3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Shim or otherwise plumb substrates receiving metal composite material panels.

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- 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
- 3. Install screw fasteners in predrilled holes.
- 4. Locate and space fastenings in uniform vertical and horizontal alignment.
- 5. Install flashing and trim as metal composite material panel work proceeds.
- 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
- 7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
- 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
  - 1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
  - 2. Copper Panels: Use copper, stainless steel or hardware-bronze fasteners.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
  - 1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
  - 1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 07 92 00 "Joint Sealants."
  - 2. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.
  - 3. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.
- F. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-returned flanges of wall panels to panel clips with manufacturer's standard fasteners.
  - 1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 07 92 00 "Joint Sealants."
  - 2. Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gaskets.

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- G. Subgirt-and-Spline Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard subgirts and splines that provide support and complete secondary drainage assembly, draining to the exterior at horizontal joints. Attach metal composite material wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
  - 1. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
  - 2. Do not apply sealants to joints unless otherwise indicated.
- H. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard horizontal tracks and vertical tracks that provide support and secondary drainage assembly, draining to the exterior at horizontal joints through drain tube. Attach metal composite material wall panels to tracks by interlocking panel edges with manufacturer's standard "T" clips.
  - 1. Attach routed-and-returned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.
  - 2. Attach flush wall panels to perimeter extrusions by engaging panel edges and by attaching with manufacturer's standard structural silicone adhesive.
  - 3. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
  - 4. Do not apply sealants to joints unless otherwise indicated.
- I. Rainscreen-Principle Installation: Install using manufacturer's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal composite material wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
  - 1. Install wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
  - 2. Do not apply sealants to joints unless otherwise indicated.
- J. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- K. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide

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concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

- 1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
- 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

# 3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet; non-accumulative; on level, plumb, and location lines as indicated; and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

# 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing agency to perform field tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.
- C. Metal composite material wall panels will be considered defective if they do not pass tests and inspections.
- D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- E. Prepare test and inspection reports.

## 3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.
- B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

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# SECTION 07 42 13.24 - ALUMINUM PLATE WALL PANELS

# PART 1 - - GENERAL

- 1.1 SECTION INCLUDES
  - A. Aluminum metal plate wall panels

## 1.2 RELATED REQUIREMENTS

- A. Section 05 40 00 Cold-Formed Metal Framing: Wall panel substrates support framing.
- B. Section 06 16 00 Sheathing: Plywood substrate wall sheathing.
- C. Section 07 27 13 Modified Bituminous Air Barriers: Air and moisture barrier required as part of metal wall panel assembly.
- D. Section 07 62 00 Sheet Metal Flashing and Trim: Field formed flashings and other sheet metal work.
- E. Section 07 92 00 Joint Sealants: Perimeter sealant.

## 1.3 DEFINITION

- A. Metal Plate Wall Panel Assembly: Metal plate wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weather tight wall system based on AAMA CW-RS-1.
- 1.4 REFERENCE STANDARDS
  - A. AAMA American Architectural Manufacturers Association (www.aamanet.org)
  - B. AAMA CW-RS-1 The Rain Screen Principle and Pressure Equalized Wall Design; 2012
  - C. AAMA 501.1 Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure; 2005
  - D. AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2009
  - E. AAMA 508 Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems; 2014 Testing based on 2007 Edition
  - F. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2014
  - G. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013 Testing based on 2005 Edition

- H. ASTM International (American Society for Testing and Materials; www.astm.org)
- I. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus; 2011
- J. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015
- K. ASTM D523 Standard Test Method for Specular Gloss; 2014
- L. ASTM D2244 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2015
- M. ASTM D2247 Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity; 2011
- N. ASTM D4214 Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 07(2015)
- O. ASTM E8/E8M Standard Test Methods for Tension Testing of Metallic Materials; 2013a
- P. 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; 04(2012)
- Q. ASTM E330/E330M Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014
- R. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 00(2009)
- S. ASTM E1233/E1233M Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Cyclic Air Pressure Differential; 2014 Testing based on 2006 Edition
- T. TAS Testing Application Standards; Florida Building Code, 2010
- U. TAS 202 Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure Loading; 1994
- V. TAS 203 Criteria for Testing Products Subject to Cyclic Wind Pressure Loading; 1994
- W. LEED Leadership in Energy and Environmental Design
- X. NAAMM National Association of Architectural Metal Manufacturers
- Y. SMACNA Sheet Metal and Air Conditioning Contractor's National Association
- Z. PS Voluntary Product Standard; National Institute of Standards and Technology (NIST)

AA. PS-1 – Structural Plywood; 2009

## 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate panel assemblies with rain drainage, flashing, trim, stud back-up, soffits, and other adjoining work.
- B. Preinstallation Meeting:
- C. Attendees:
  - 1. Owner.
  - 2. Architect.
  - 3. Installer.
  - 4. Panel manufacturer's representative.
  - 5. Structural support installer's.
  - 6. Installer's whose work interfaces with or affects wall panels including installers of doors, windows, and louvers.
- D. Review and finalize construction schedule.
- E. Verify availability of materials, installer's personnel, equipment, and facilities needed to maintain schedule.
- F. Review means and methods related to installation, including manufacturer's written instructions.
- G. Examine support conditions for compliance with requirements, including alignment and attachment to structural members.
- H. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affects this Work.
- I. Review temporary protection requirements for during and after installation of this Work.

## 1.6 SUBMITTALS

- A. See Section 01 30 00 Administrative Requirements, for submittal procedures.
- B. Product Data: Submit for each type of product indicated, include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal plate wall panel and accessory.
- C. Shop Drawings: Submit fabrication and installation layouts of metal plate wall panels; including details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
- D. Provide distinction between factory-assembled, shop-assembled, and field-assembled work.
- E. Provide details of following items at full scale.
  - 1. Manufacturer's standard sheet metal trims.
  - 2. Components of wall panel construction, anchorage methods, and hardware.
- F. Coordination Drawings: Submit exterior elevations, drawn to scale, that have the following items shown and coordinated with each other, using input from installers of the following items:
- G. Metal plate wall panels and attachments.
- H. Girts.
- I. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
- J. Penetrations of wall by pipes and utilities.
- K. Samples: Submit for each type of exposed finish required, and prepared on samples of size as follows:
- L. Aluminum Metal Plate Wall Panels: At least 2 inch by 3 inch.
- M. Test and Inspection Reports: Submit test and inspection reports on each type of wall panel system provided for project based on evaluation of comprehensive tests performed by qualified testing agency.
- N. Maintenance Data: Submit maintenance data for metal plate wall panels.
- O. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

## 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least five years of documented experience.
- B. Installer: Company specializing in performing work of this section and approved by manufacturer.
- C. Install system in strict compliance with manufacturer's installation instructions.
- D. Anodized Finish Applicator: Provide either caustic (traditional) or eco-friendly (acid) etching technologies.
- E. Use fully automated, computer-controlled process lines for consistency of finish throughout project.
- F. Use documented production line quality control protocols in accordance with AAMA 611 test procedures.

G. Source Limitations: Obtain each type of metal plate wall panel from single source and from single manufacturer.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling: Store materials in clean, dry, interior area in accordance with manufacturer's instructions.
- C. Deliver panels, components, and other manufactured items without damage or deformation.
- D. Protect panels during transportation, handling, and installation from weather, excessive temperatures and construction operations.
- E. Handle panels in strict compliance with manufacturer's instructions and recommendations, and in a manner to prevent bending, warping, twisting, and surface damage.
- F. Store panels vertically with top of panel down, storage of panels horizontally is not permitted.
- G. Store panels covered with suitable weather tight and ventilated covering.
- H. Provide storage of panels to ensure dryness, with positive slope for drainage of moisture.
- I. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
- J. Remove strippable protective covering from aluminum panel prior to installation.
- 1.9 SITE CONDITIONS
  - A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of this Work to be performed according to manufacturer's installation instructions and warranty requirements.
  - B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before panel fabrication and indicate measurements on Shop Drawings.
  - C. Coordinate with construction schedule.

## 1.10 WARRANTY

- A. See Section 01 78 00 Closeout Submittals, for additional warranty requirements.
- B. Wall System Warranty: Provide wall panel manufacturer warranty, agreeing to correct defects in manufacturing of materials within a one year period after Date of Substantial Completion.

- C. Failures include, but are not limited to, the following:
  - 1. Structural failures, including rupturing, cracking, or puncturing.
  - 2. Deterioration: Beyond normal weathering of wall system metals and other materials.
- D. Panel Material Warranty: Provide panel material manufacturer warranty, agreeing to repair finish of metal plate wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
- E. Finish Warranty Period: 20 years from Date of Substantial Completion.
- F. Warranty Coverage: In accordance with AAMA 2605 for 70 percent PVDF resin on aluminum finish requirements.
  - 1. Fading, Loss of Color Retention: Loss of 5 Delta E units (Hunter) or less, in accordance with ASTM D2244.
  - 2. Chalking, Chalky White Powder on Panel Surface: Chalking at No. 8 or less for colors, or No. 6 for white, in accordance with ASTM D4214.
  - 3. Loss of Adhesion: Loss of 10 percent due to cracking, checking or peeling, or failure to adhere to bare metal.
  - 4. Gloss Retention: 50 percent or less in accordance with ASTM D523.
  - 5. Salt Spray, Accelerated: At least 4,000 hours in accordance with ASTM B117.
  - 6. Humidity Testing, Accelerated: At least 4,000 hours in accordance with ASTM D2247.
- G. Warranty Coverage: In accordance with AAMA 611 Class 1 anodized aluminum finish requirements.
  - 1. Loss of Adhesion: Resists cracking, crazing, flaking, and blistering when forming and welding completed prior to finishing; post forming or welding voids warranty.
  - 2. Fading Loss of Color Retention: Loss of 5 Delta E units (Hunter) or less, in accordance with ASTM D2244.
  - 3. Chalking, Chalky White Powder on Panel Surface: Chalking at No. 8 or less in accordance with ASTM D4214.
  - 4. Salt Spray, Accelerated: At least 3,000 hours in accordance with ASTM B117.

## PART 2 - - PRODUCTS

## 2.1 MANUFACTURERS

- A. Dri-Design Aluminum Wall Panel System.
- B. Address: 12480 Superior Ct., Holland, Michigan 49424.
- C. P.O. Box 1286 Holland, Michigan 49422-1286.
- D. Phone: (616) 355-2970; Fax: (616) 355-2972; Website: www.dri-design.com.
- 2.2 PERFORMANCE REQUIREMENTS
  - A. Metal Plate Wall Panel Assemblies: Comply with performance requirements without failure due to defective manufacturing, fabrication, installation, or other construction defects.

- B. Design, fabricate, and erect a dry joint, pressure equalized rainscreen aluminum wall panel system without use of sealants, gaskets, or butyl tape, tested as installed in compliance with AAMA 508, and as follows:
- C. Cyclic Static Air Pressure Differential: Pass cycled pressure loading at 25 psf in 100 threesecond cycles in accordance with ASTM E1233/E1233M.
- D. Air Infiltration: Pass when tested at 1.57 psf (25 mph) in accordance with ASTM E283.
- E. Water Penetration:
  - 1. Static: Pass water penetration test under 25.0 psf positive static air pressure difference for at least 15 minutes with 5 gallons per sf per hour of water applied in accordance with ASTM E331.
  - 2. Dynamic: Pass water penetration test under 15.0 psf dynamic pressure difference for at least 15 minutes with 5 gallons per sf per hour of water applied in accordance with AAMA 501.1.
- F. Structural: Provide systems tested in accordance with ASTM E330/E330M and certified to be without permanent deformation or failure of structural members.
- G. High Velocity Hurricane Zone (HVHZ): Comply with ASTM E8/E8M test methods and performance requirements of Florida Building Code and Miami-Dade County test protocols TAS-202 and TAS-203 for HVHZ with at least plus 61 psf to minus 80 psf design pressure rating.
- H. Application: For aluminum plate thickness of 0.080 inch only.
- 2.3 MATERIALS
  - A. Aluminum Plate: Alloy and temper as recommended by manufacturer for application and in compliance with manufacturers design requirements.
  - B. Aluminum Material: Tension-leveled, flouropolymer PVDF painted finish, 3003-H14 manganese alloy or anodized finish, 5005-AQ manganese alloy.
  - C. Thickness: 0.080 inch.
  - D. Weight: Less than 2 lbs per sf.
  - E. Finish: Two-Coat Fluoropolymer or .
  - F. Panel Depth: 1-1/4 inch, nominal.
  - G. Panel Size: As indicated on Drawings.
  - H. Panel Joints: As indicated on Drawings.

## 2.4 FABRICATION

- A. Fabricate and finish wall panels within manufacturer's facilities and fulfill indicated performance requirements demonstrated by laboratory testing.
- B. Comply with indicated profiles and with dimensional and structural requirements.
- C. Provide post-finishing of panels, paint aluminum wall panels only after completion of panel fabrication and ensure exposed edges are coated.
- D. Provide post anodizing of panels, anodize aluminum wall panels only after completion of panel fabrication and ensure exposed edges are anodic coated without crazing of surface at formed edges.

## 2.5 FINISHES

- A. Comply with NAAMM's Metal Finishes Manual for Architectural and Metal Products, for recommendations of designating finishes.
- B. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) resin system.
- C. Two-Coat Fluoropolymer: AAMA 2605, fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' installation instructions.
- D. Field Touch-Up Materials: As recommended by coating manufacturer for field application.

## 2.6 ACCESSORIES

- A. Metal Plate Wall Panel Accessories: Provide components required for a complete metal plate wall panel assembly including trim, copings, fascia, mullions, sills, corner units, flashings, and similar items. Match material and finish of panels unless otherwise indicated.
- B. Provide integral drainage system and manufactures standard extrusions at termination of dissimilar materials.
- C. Flashing and Trim: Match material, finish, and color of adjacent wall panels.1. Thickness: At least 0.040 inch.
- D. Panel Fasteners: Designed to withstand design loads, with at least 7/16 inch diameter head and neoprene washer.
- E. Aluminum Wall Panel Material: Provide stainless steel fasteners, or coated fastener approved by panel manufacturer or project wall consultant.
- F. Sub-Girts: Galvanized, provide size and gage in accordance with project requirements.

- G. Furring Channel: Provide Hat, C, U or Z type as recommended by manufacturer.
- H. Flat Strap: At least 14 gage, 0.0747 inch (1.90 mm) thick.
- I. Refer to Section 05 40 00
- J. Substrate Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I, at least 5/8 inch thick.
- K. Refer to Drawings and Section 06 10 00 for requirements.
- L. Weather Barriers: Provide climate specific weather barrier with performance characteristics for air penetration, water vapor transmission, and water penetration resistance.
- M. Refer to Section 07 25 00 for requirements.
- N. Sealants: As recommended by metal panel manufacturer for openings within wall panels and perimeter conditions.
- O. Refer to Section 07 92 00 for requirements.

## PART 3 - - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, and Work areas and conditions with Installer present for compliance with requirements for installation tolerances, wall panel supports, and other conditions affecting performance of this Work.
- B. Examine wall framing to verify that girts, angles, channels, studs, and other structural wall panel support members and anchorage have been installed within alignment tolerances required by wall panel manufacturer.
- C. Verify that weather barrier has been installed over sheathing or substrate to prevent air infiltration or water penetration.
- D. Examine rough-in for components and systems penetrating wall panels to coordinate actual penetration locations relative to wall panel joint locations prior to installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Miscellaneous Framing: Install sub girt, base angles, sills, furring, and other wall panel support members and provide anchorage in accordance with ASTM C754 for gypsum panel type substrates and panel manufacturer's installation instructions.

#### 3.3 INSTALLATION

- A. Install wall panels in accordance with manufacturer's installation instructions, including pressure equalized rainscreen installation method and installation guidelines.
- B. Wall panels consist of single sheets of metal formed with interlocking gutter and drainage system integral to the panel with single horizontal attachment for dry-joint rainscreen assembly.
- C. Use of secondary drainage channels, brackets, support pins, joint sealants or gaskets to manage the drainage of wall panel system is not permitted.
- D. Attach wall panels using progressive interlocking method, engaging bottom of panel in top of previous panel working bottom up, and left to right.
- E. Install wall panels with single top attachment in pre-punched holes to allow individual panels to move due to thermal expansion.
- F. Do not compromise internal gutter.
- G. Install wall panels for orientation, sizes, and locations as indicated on Drawings.
- H. Install wall panels with proper anchorage and other components for this Work securely in place.
- I. Install wall panels with provisions for thermal and structural movement.
- J. Install shims to plumb substrates as necessary for installation of wall panels.
- K. Install weather tight seals at perimeter of wall panel openings.
- L. Test for proper adhesion on small unexposed area of solid surfacing prior to use.
- M. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA Architectural Sheet Metal Manual.
- N. Provide concealed fasteners where possible, and set units true to line and level as indicated.
- O. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- P. Install flashing and trim as wall panel Work proceeds.
- Q. Install weather tight escutcheons for pipe and conduit penetrating exterior walls.
- R. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by wall panel manufacturer.

- S. Install attachment system to support wall panels and with provisions to provide a complete weather tight wall system, including sub girts, extrusions, flashings and trim.
- T. Include attachment to supports and trims at locations using dissimilar materials.
- U. Do not apply sealants to joints, unless noted otherwise on Drawings or Shop Drawings.
- V. Install starter extrusion at base course and at cut panel locations.
- W. Install accessories with positive anchorage to building and weather tight mounting and provisions for thermal expansion, and coordinate installation with flashings and other components.
- X. Install components required for a complete wall panel assembly including trim, copings, flashings and other accessory items.
- Y. Weather Barrier: Install weather barrier behind wall panels and over substrate in accordance with requirements of Section 07 25 00.

#### 3.4 TOLERANCES

- A. Shim and align wall panel units with installed tolerances of 1/4 inch in 20 feet, non-cumulative, on level, plumb, and location lines as indicated.
- 3.5 FIELD QUALITY CONTROL
  - A. Testing Agency: Owner will engage or a qualified independent testing agency to perform field tests and inspections.
  - B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
  - C. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
  - D. Perform additional tests and inspections, at Contractor's expense, to verify compliance of replaced wall panels or necessary additional work with specified requirements.
  - E. Prepare test and inspection reports.
- 3.6 CLEANING
  - A. Upon completion of wall panel installation, clean finished surfaces as recommended by panel manufacturer.
  - B. Upon completion of wall panel installation, clear weep holes and drainage channels of obstructions and dirt.

## 3.7 PROTECTION

- A. Protect installed products from damage during subsequent construction.
- B. Replace wall panels damaged or deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.24

# SECTION 07 53 23 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
  - 2. Accessory roofing materials.
  - 3. Substrate board.

# 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For insulation and roof system component fasteners, include copy of SPRI's Directory of Roof Assemblies listing.
- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
  - 1. Layout and thickness if insulation.
  - 2. Base flashings and membrane terminations.
  - 3. Flashing details at penetrations.
  - 4. Tapered insulation, thickness, and slopes.
  - 5. Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
  - 6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
  - 7. Tie-in with air barrier.

PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
  - A. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
  - B. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
  - C. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
    - 1. Wind Uplift Load Capacity: 90 psf .

## 2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

- A. EPDM Sheet: ASTM D4637/D4637M, Type I, nonreinforced, EPDM sheet.
  - 1. <u>Manufacturers:</u> 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. Carlisle Syntec Systems.
    - b. Firestone Building Products.
  - 2. Thickness: 60 mils , nominal.
  - 3. Exposed Face Color: Black .

# 2.3 ACCESSORY ROOFING MATERIALS

- A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
  - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.
- C. Bonding Adhesive: Manufacturer's standard.
- D. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- wide minimum, butyl splice tape with release film .
- E. Lap Sealant: Manufacturer's standard, single-component sealant , colored to match membrane roofing.
- F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- G. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosionresistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.
- I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
  - 1. Provide white flashing accessories for white EPDM membrane roofing.

# 2.4 SUBSTRATE BOARD

A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.

ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING 07 53 23 - 2

- 1. <u>Manufacturers</u>: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Certainteed; SAINT-GOBAIN.
  - b. Georgia-Pacific Gypsum LLC.
  - c. National Gypsum Company.
  - d. USG Corporation.
- 2. Thickness: Type X, 5/8 inch.
- 3. Surface Finish: Factory primed .
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosionresistance provisions in FM Approvals 4470, designed for fastening substrate panel to roof deck.
- PART 3 EXECUTION
- 3.1 EXAMINATION
  - A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

## 3.2 PREPARATION

- A. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
  - 1. Submit test result within 24 hours of performing tests.
    - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

## 3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, SPRI's Directory of Roof Assemblies assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 07 27 13 "Modified Bituminous Sheet Air Barriers."

## 3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.
  - 1. At steel roof decks, install substrate board at right angle to flutes of deck.
    - a. Locate end joints over crests of steel roof deck.
  - 2. Tightly butt substrate boards together.
  - 3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
  - 4. Fasten substrate board to top flanges of steel deck according to recommendations in SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29.
  - 5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

## 3.5 ADHERED ROOFING INSTALLATION

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll membrane roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- F. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer, and install fabric-backed roofing. Do not apply to splice area of roof membrane.
- G. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.
- H. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.
- I. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- J. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.
  - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.

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- 2. Apply lap sealant and seal exposed edges of roofing terminations.
- 3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
- K. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.
  - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
  - 2. Apply lap sealant and seal exposed edges of roofing terminations.
- L. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.
  - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
  - 2. Apply lap sealant and seal exposed edges of roofing terminations.
- M. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.
- N. Adhere protection sheet over roof membrane at locations indicated.
- 3.6 INSTALLATION OF BASE FLASHING
  - A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
  - B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
  - C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
  - D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
  - E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

END OF SECTION 07 53 23

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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:1. Formed wall sheet metal fabrications.

## 1.2 ACTION SUBMITTALS

A. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

## 2.2 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
  - 1. Exposed Coil-Coated Finish:
    - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- b. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
- 2. Color: Custom as Indicated by Architect.
- 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- C. Stainless Steel Sheet: ASTM A240/A240M, Type 304 , dead soft, fully annealed; with smooth, flat surface.
  - 1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled) .
- D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A755/A755M.
  - 1. Surface: Smooth, flat and mill phosphatized for field painting .
  - 2. Exposed Coil-Coated Finish:
    - a. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
  - 3. Color: As selected by Architect from manufacturer's full range .
  - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

# 2.3 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
  - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
    - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
  - 2. Fasteners for Copper Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
  - 3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

- 4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- 5. Fasteners for Zinc-Coated (Galvanized)orAluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

# 2.4 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
  - 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  - 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  - 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
  - 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  - 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
  - Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
  - 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
  - 2. Use lapped expansion joints only where indicated on Drawings.

- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Seams:
  - 1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
  - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- 2.5 WALL SHEET METAL FABRICATIONS
  - A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:
    - 1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

# PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
  - A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
    - 1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
    - 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
    - 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
    - 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
    - 5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
    - 6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
    - 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
    - 8. Do not field cut sheet metal flashing and trim by torch.
  - B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
    - 1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

1.

- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
  - 1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
  - 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- E. Seal joints as required for watertight construction.
  - Use sealant-filled joints unless otherwise indicated.
    - a. Embed hooked flanges of joint members not less than **1** inch into sealant.
    - b. Form joints to completely conceal sealant.
    - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
    - d. Adjust setting proportionately for installation at higher ambient temperatures.
      - 1) Do not install sealant-type joints at temperatures below 40 deg F.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

## 3.2 INSTALLATION OF WALL FLASHINGS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend beyond wall openings.

# 3.3 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

# 3.4 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

#### 3.5 PROTECTION

- Α. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- Β. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 62 00

SECTION 07 72 00 - ROOF ACCESSORIES

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Roof hatches.

## PART 2 - PRODUCTS

- 2.1 ROOF HATCHES
  - A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
    - 1. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide <u>BILCO</u> <u>Company (The)</u>; THERMALLY BROKEN ROOF HATCH Type E-50TB or comparable product by one of the following:
      - a. Babcock-Davis.
      - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
      - c. Nystrom.
    - 2. Type and Size: Single-leaf lid, .
    - 3. Loads: Minimum 40-lbf/sq. ft. external live load and 30-lbf/sq. ft. internal uplift load.
      - a. When release is actuated, lid shall open against 10-lbf/sq. ft. snow or wind load and lock in position.
      - b. Cover: Shall be 11 gauge (2.3mm) aluminum with a 5" (127mm) beaded flange with formed reinforcing members. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. Cover shall have a heavy extruded EPDM rubber gasket bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
      - c. Cover insulation: Shall be 3" (75mm) thick polyisocyanurate with an R-value = 20.3 (U=0.279 W/m2K), fully covered and protected by an 18 gauge (1mm) aluminum liner.
    - 4. Curb, Framing, and Lid Material: Zinc-coated (galvanized) steel sheet.
      - a. Shall be 12" (305mm) in height and of 11 gauge (2.3mm) aluminum. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. The curb shall be formed with a 5-1/2" (140mm) flange with 7/16" (11mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place
      - b. F. Curb insulation: Shall be 3" (75mm) thick polyisocyanurate with an R-value = 20.3 (U=0.279 W/m2K).

- c. Finish: Two-coat fluoropolymer .
- d. Color: As selected by Architect from manufacturer's full range .
- 5. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe welded to the curb assembly.
- 6. Hardware: Manufacturer's standard stainless steel; with hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids.
  - a. Heavy stainless steel pintle hinges shall be provided
  - b. Cover shall be equipped with a spring latch with interior and exterior turn handles
  - c. Roof hatch shall be equipped with interior and exterior padlock hasps.
  - d. The latch strike shall be a stamped component bolted to the curb assembly.
  - e. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25mm) diameter red vinyl grip handle to permit easy release for closing.
  - f. All hardware shall be zinc plated and chromate sealed
  - g. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

## 2.2 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.
  - 1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, AZ50 coated.
  - 1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
- C. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
  - 1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
- D. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
- E. Stainless Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.
- F. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

- G. Steel Tube: ASTM A500/A500M, round tube.
- H. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.
- I. Steel Pipe: ASTM A53/A53M, galvanized.

## 2.3 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.
- C. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
- D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- E. Elastomeric Sealant: ASTM C920, elastomeric polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

## PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.
  - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
  - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
  - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
  - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

- 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
- C. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.
- 3.2 REPAIR AND CLEANING
  - A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.
  - B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 91 13 "Exterior Painting."
  - C. Clean exposed surfaces according to manufacturer's written instructions.
  - D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

## SECTION 07 92 00 - JOINT SEALANTS

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Silicone joint sealants.
    - 2. Nonstaining silicone joint sealants.
    - 3. Urethane joint sealants.
    - 4. Mildew-resistant joint sealants.
    - 5. Latex joint sealants.

#### PART 2 - PRODUCTS

- 2.1 JOINT SEALANTS, GENERAL
  - A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
- 2.2 SILICONE JOINT SEALANTS
  - A. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
    - 1. <u>Manufacturers</u>: 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. May National Associates, Inc.; a subsidiary of Sika Corporation.
      - b. Pecora Corporation.
      - c. Sika Corporation; Joint Sealants.
      - d. The Dow Chemical Company.
- 2.3 NONSTAINING SILICONE JOINT SEALANTS
  - A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
  - B. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
    - 1. <u>Manufacturers</u>: 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. The Dow Chemical Company.

## 2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
  - 1. <u>Manufacturers</u>: 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. Sika Corporation; Joint Sealants.

## 2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
  - 1. <u>Manufacturers</u>: 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. Pecora Corporation.
    - b. Sherwin-Williams Company (The).
    - c. Tremco Incorporated.

## 2.6 JOINT-SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
  - 1. <u>Manufacturers</u>: 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. Adfast.
    - b. Alcot Plastics Ltd.
    - c. BASF Corporation.
    - d. Construction Foam Products; a division of Nomaco, Inc.

## 2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

JOINT SEALANTS

#### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove laitance and form-release agents from concrete.
  - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

## 3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 1. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

END OF SECTION 07 92 00

## SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

A. Section includes:1. Exterior standard steel doors and frames.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door type.
  - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
- C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. <u>Manufacturers:</u> 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. Ceco Door; ASSA ABLOY.
  - 2. Curries Company; ASSA ABLOY.
  - 3. Republic Doors and Frames.
  - 4. Steelcraft; an Allegion brand.

# 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.
- B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. when tested according to ASTM C518.

## 2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. .
  - 1. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
    - d. Edge Construction: Model 2, Seamless .
    - e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
    - f. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
    - g. Core: Polystyrene .
  - 2. Frames:
    - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
    - b. Construction: Full profile welded.

# 2.4 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
  - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
  - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

# 2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

HOLLOW METAL DOORS AND FRAMES

- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

# 2.6 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
  - 1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
- B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
  - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
  - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.

- 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
- 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

# 2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

# PART 3 - EXECUTION

# 3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

# 3.2 INSTALLATION

- A. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
    - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    - b. Install frames with removable stops located on secure side of opening.
  - 2. Fire-Rated Openings: Install frames according to NFPA 80.
  - 3. Floor Anchors: Secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  - 4. Solidly pack mineral-fiber insulation inside frames.
  - 5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
  - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors.
  - 7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

- c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
- d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
  - 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8 .
- C. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollowmetal manufacturer's written instructions.

# 3.3 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

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## SECTION 08 12 13 - HOLLOW METAL FRAMES

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:1. Interior standard steel frames.

## 1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
- 1.3 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Shop Drawings: Include elevations, frame profiles, metal thicknesses, and wall opening conditions.
- PART 2 PRODUCTS
- 2.1 MANUFACTURERS
  - A. <u>Manufacturers:</u> 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. Ceco Door; AADG, Inc.; ASSA ABLOY.
    - 2. Curries, AADG, Inc.; ASSA ABLOY Group.
    - 3. Republic Doors and Frames; a Allegion brand.
    - 4. Steelcraft; Allegion plc.
- 2.2 FRAME ANCHORS
  - A. Jamb Anchors:
    - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
    - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
    - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
  - B. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

C. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

## 2.3 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

# 2.4 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
  - 1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding , or by rigid mechanical anchors.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- B. Hardware Preparation: Factory prepare hollow-metal frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
  - 1. Reinforce frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with BHMA A156.115 for preparing hollow-metal frames for hardware.

# 2.5 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  - 1. Shop Primer: SDI A250.10.
- B. Factory Finish: SDI A250.3.
  - 1. Color and Gloss: Custom as indicated on Finish Legend .

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. General: Install hollow-metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions. Comply with SDI A250.11.
- B. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
  - 1. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
  - 2. Install frames with removable stops located on secure side of opening.
- C. Fire-Rated Openings: Install frames according to NFPA 80.
- D. Floor Anchors: Secure with postinstalled expansion anchors.
  - 1. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- E. Solidly pack mineral-fiber insulation inside frames.
- F. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
  - 1. Squareness: Plus or minus 1/16 inch , measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - 2. Alignment: Plus or minus 1/16 inch , measured at jambs on a horizontal line parallel to plane of wall.
  - 3. Twist: Plus or minus 1/16 inch , measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - 4. Plumbness: Plus or minus 1/16 inch , measured at jambs at floor.
- G. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollowmetal manufacturer's written instructions.
- 3.2 CLEANING AND TOUCHUP
  - A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
  - B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
  - C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in D. painting Sections.

END OF SECTION 08 12 13

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# SECTION 08 14 16 - FLUSH WOOD DOORS

# PART 1 - GENERAL

# 1.1 SUMMARY

- A. Section Includes:
  - 1. Five-ply flush wood veneer-faced doors for transparent finish.
  - 2. Factory finishing flush wood doors and frames.
  - 3. Factory fitting flush wood doors to frames and factory machining for hardware.

# 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:
  - 1. Door core materials and construction.
  - 2. Door edge construction
  - 3. Door face type and characteristics.
  - 4. Door trim for openings.
  - 5. Factory-machining criteria.
  - 6. Factory- finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
  - 1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
  - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
  - 3. Details of frame for each frame type, including dimensions and profile.
  - 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
  - 5. Dimensions and locations of blocking for hardware attachment.
  - 6. Clearances and undercuts.
  - 7. Requirements for veneer matching.
- C. Samples: For factory-finished doors and factory-finished door frames.
- PART 2 PRODUCTS
- 2.1 FLUSH WOOD DOORS AND FRAMES, GENERAL
  - A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.
- 2.2 SOLID-CORE, FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH
  - A. Interior Doors :

- 1. <u>Manufacturers:</u> 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. Eggers Industries.
  - b. Lambton Doors.
  - c. Masonite Architectural.
  - d. Oshkosh Door Company.
  - e. VT Industries Inc.
- 2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty .
- 3. Performance Grade:
  - a. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated on Drawings.
  - b. ANSI/WDMA I.S. 1A Extra Heavy Duty: public toilets janitor's closets assembly spaces exits and and where indicated on Drawings.
- 4. ANSI/WDMA I.S. 1A Grade: Custom.
- 5. Faces: Single-ply wood veneer not less than 1/50 inch thick.
  - a. Species: Select white maple .
  - b. Cut: Plain-sliced .
  - c. Match between Veneer Leaves: Slip match.
  - d. Assembly of Veneer Leaves on Door Faces: Running match.
  - e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
  - f. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
- 6. Exposed Vertical Edges: Same species as faces or a compatible species Architectural Woodwork Standards edge Type A .
- 7. Core for Non-Fire-Rated Doors:
  - a. ANSI A208.1, Grade LD-1 particleboard.
    - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
      - a) **5-inch** top-rail blocking, in doors indicated to have closers.
      - b) **5-inch** bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
      - c) 5-inch midrail blocking, in doors indicated to have exit devices.
    - 2) Provide doors with glued-wood-stave or WDMA I.S. 10 structuralcomposite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 71 11 "Door Hardware (Descriptive Specification."
  - b. Glued wood stave.
  - c. WDMA I.S. 10 structural composite lumber.
    - 1) Screw Withdrawal, Face: 475 lb.
    - 2) Screw Withdrawal, Edge: 475 lb.
  - d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
- 8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

# 2.3 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
  - 1. Wood Species: Same species as door faces .
  - 2. Profile: Flush rectangular beads .
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard woodveneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

# 2.4 FABRICATION

- A. Factory machine doors for hardware that is not surface applied.
  - 1. Locate hardware to comply with DHI-WDHS-3.
  - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
  - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
  - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
  - 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- B. Openings: Factory cut and trim openings through doors.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."
  - 3. Louvers: Factory install louvers in prepared openings.
- C. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before factory finishing.
  - 1. Flash top of outswinging doors with manufacturer's standard metal flashing.

# 2.5 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
  - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  - 2. Finish faces, all four edges, edges of cutouts, and mortises.
  - 3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
  - 1. ANSI/WDMA I.S. 1A Grade: Custom.

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- 2. Finish: ANSI/WDMA I.S. 1A TR-6 Catalyzed Polyurethane.
- 3. Staining: Clear .
- 4. Sheen: Satin .

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Hardware: For installation, see Section 08 71 11 "Door Hardware (Descriptive Specification)."
- B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
  - 1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
  - 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
    - a. Secure with countersunk, concealed fasteners and blind nailing.
    - b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
      - 1) For factory-finished items, use filler matching finish of items being installed.
  - 3. Install fire-rated doors and frames in accordance with NFPA 80.
  - 4. Install smoke- and draft-control doors in accordance with NFPA 105.
- D. Job-Fitted Doors:
  - 1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
    - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
  - 2. Machine doors for hardware.
  - 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 4. Clearances:
    - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
    - b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
    - c. Where threshold is shown or scheduled, provide1/4 inch from bottom of door to top of threshold unless otherwise indicated.
    - d. Comply with NFPA 80 for fire-rated doors.
  - 5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
  - 6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

#### 3.2 ADJUSTING

- Operation: Rehang or replace doors that do not swing or operate freely. Α.
- Β. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

# FLUSH WOOD DOORS

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SECTION 08 33 13 - COILING COUNTER DOORS

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:1. Counter door assemblies.
  - B. Related Requirements:
    - 1. Section 05 50 00 "Metal Fabrications" for door-opening framing and corner guards.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type and size of coiling counter door and accessory.
  - B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
    - 1. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
    - 2. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
    - 3. Include diagrams for power, signal, and control wiring.

## PART 2 - PRODUCTS

- 2.1 COUNTER DOOR ASSEMBLY
  - A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
    - 1. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide <u>Cornell</u>; ESC10 / ESC20 with Frame and sill or comparable product by one of the following:
      - a. Cookson Company.
  - B. Operation Cycles: Door components and operators capable of operating for not less than 10,000.
  - C. Door Curtain Material: Galvanized steel .
  - D. Door Curtain Slats: Flat profile slats of 1-1/4-inch center-to-center height.
  - E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated stainless steel and finished to match door.
  - F. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

- G. Sill Configuration: No sill .
- H. Locking Devices: Equip door with locking device assembly .
  - 1. Locking Device Assembly: Single-jamb side locking bars, operable from inside with thumbturn .
- I. Manual Door Operator: Push-up operation .
- J. Curtain Accessories: Equip door with pull-down strap .
- K. Door Finish:
  - 1. Baked-Enamel or Powder-Coated Finish: Color matching Architect's sample .
- 2.2 MATERIALS, GENERAL
  - 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.
- 2.3 DOOR CURTAIN MATERIALS AND FABRICATION
  - A. Door Curtains: Fabricate coiling counter door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
    - 1. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection-rated glass as required for type of door; set in glazing channel secured to curtain slats.
    - 2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
    - 3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
    - 4. Plastic Interior Curtain-Slat Facing: Extruded PVC plastic with maximum flame-spread index of 25 and smoke-developed index of 450, according to ASTM E84 or UL 723.
  - B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.
    - 1. Removable Posts and Jamb Guides: Manufacturer's standard.
- 2.4 HOODS
  - A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

- 1. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.
- B. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):
- 2.5 LOCKING DEVICES
  - A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
  - B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
  - C. Chain Lock Keeper: Suitable for padlock.

# 2.6 CURTAIN ACCESSORIES

- A. Astragal: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
- C. Pull-Down Strap: Provide pull-down straps for doors more than 84 inches high.

# 2.7 COUNTER DOOR ACCESSORIES

A. Integral Metal Sill: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with ASTM A480/A480M No. 4 finish.

## 2.8 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

## 2.9 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf.

PART 3 - EXECUTION

- 3.1 **INSTALLATION, GENERAL** 
  - Α. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

END OF SECTION 08 33 13

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PRODUCT MASTERSPEC LICENSED BY DELTEK, INC. TO C.H.I. OVERHEAD DOOR

#### SECTION 08 36 13 - SECTIONAL DOORS

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 manually operated sectional doors.
- B. Related Requirements:
  - 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.
  - 2. Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for finish painting of factory-primed doors.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
  - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
  - 1. Include plans, elevations, sections, and mounting details.
  - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Upon request, provide points of attachment and their corresponding static and dynamic loads imposed on structure.
- C. Samples for Initial Selection: For units with factory-applied finishes.
  - 1. Include Samples of accessories involving color selection.
- D. Samples for Verification: Upon request, provide for each type of exposed finish on the following components, in manufacturer's standard sizes:
  - 1. Flat door sections.
  - 2. Frame for paneled door sections; of each width of stile and rail required.
  - 3. Panel for raised-panel door sections; not smaller than required to show raised-panel profile.
- 1.4 INFORMATIONAL SUBMITTALS
  - A. Qualification Data: For Installer.

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- B. Sample Warranties: For special warranties.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Maintenance Data: For sectional doors to include in maintenance manuals.

## 1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

#### 1.7 WARRANTY

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

#### PART 2 - PRODUCTS

- 2.1 MANUFACTURERS, GENERAL
  - A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
    1. Obtain operators and controls from sectional door manufacturer.
- 2.2 PERFORMANCE REQUIREMENTS
  - A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
  - B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
    - 1. Design Wind Load: As indicated on Drawings .
    - 2. Testing: According to ASTM E 330 or DASMA 108 for garage doors and complying with the acceptance criteria of DASMA 108.
    - 3. Deflection Limits: Design sectional doors to withstand design wind loads without disengagement of door components.
      - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
      - b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.

## 2.3 DOOR ASSEMBLY

- A. Steel Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide C.H.I. Overhead Doors, Inc.; Aluminum Full-View Sectional Door - Model 3295 or a comparable product by one of the following:

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- a. Clopay Building Products.
- b. Overhead Door Corporation.
- c. Raynor.
- B. Operation Cycles: Door components and operators capable of operating for not less than 10,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Installed R-Value: 17.54 deg F x h x sq. ft./Btu .
- D. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 zinc coating.
  - 1. Section Thickness: 2 inches.
  - 2. Exterior-Face, Steel Sheet Thickness: 20 guage nominal coated thickness.
    - a. Surface: Manufacturer's standard, grooved.
  - 3. Insulation: Foamed in place.
  - 4. Interior Facing Material: Zinc-coated (galvanized) steel sheet with a nominal coated thickness of 20 guage .
- E. Track Configuration: High-lift track.
- F. Weatherseals: Fitted to bottom and top and around entire perimeter of door.
- G. Roller-Tire Material: Case-hardened steel .
- H. Locking Devices: Equip door with locking device assembly .1. Locking Device Assembly: locking bars, operable from inside .
- I. Counterbalance Type: Torsion spring.
- J. Manual Door Operator: Push-up operation .
- K. Door Finish:
  - 1. Powder-Coat Finish: Color and gloss matching Architect's sample Custom as indicated on Building Elevations .
  - 2. Factory Prime Finish: Manufacturer's standard color.
  - 3. Finish of Interior Facing Material: Custom as indicated on Finish Legend .

## 2.4 MATERIALS, GENERAL

- 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.
- 2.5 STEEL DOOR SECTIONS
  - A. Exterior Section Faces and Frames: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.

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- 1. Fabricate section faces from single sheets to provide sections not more than 24 inches high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, tongue-and-groove weather-resistant seal, with a reinforcing flange return.
- 2. For urethane insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
- B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.034-inch nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.034-inch thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
- C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile.
- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel, struts, formed to depth and bolted or welded in place.
- E. Provide reinforcement for hardware attachment.
- F. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel sections and the interior facing material, with no exposed insulation.
- G. Interior Facing Material: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated thickness.
- H. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

## 2.6 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.
  - 1. Galvanized Steel: ASTM A 653/A 653M, minimum G40 zinc coating.
  - 2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
  - 3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors.
    - a. For Vertical Track: Intermittent, jamb brackets attached to track and attached to wall.

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- b. For Horizontal Track: Continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

# 2.7 HARDWARE

- A. General: Heavy-duty, corrosion-resistant hardware, with corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with self-tapping fasteners. Provide double-end hinges where required, for doors more than 16 feet wide unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch diameter roller tires for 3-inch wide track and 2-inch diameter roller tires for 2-inch wide track.
- D. Push/Pull Handles: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on inside of door.

## 2.8 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
- B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
  - 1. Lock Cylinders: Cylinders standard with manufacturer.
  - 2. Keys: Two for each cylinder.
- C. Chain Lock Keeper: Suitable for padlock.
- D. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

# 2.9 COUNTERBALANCE MECHANISM

A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.

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- B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.
- C. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.
- D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- F. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.
- 2.10 MANUAL DOOR OPERATORS
  - A. General: Equip door with manual door operator by door manufacturer.
  - B. Push-up Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf.
- 2.11 GENERAL FINISH REQUIREMENTS
  - A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
  - B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- 2.12 STEEL AND GALVANIZED-STEEL FINISHES
  - A. Factory Baked Enamel Finish: Manufacturer's standard baked enamel finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
  - B. Powder-Coat Finish: Manufacturer's standard powder coat finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks:
  - 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
  - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

## 3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780/A 780M.

# 3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 08 36 13

# SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

# 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. Aluminum-framed storefront systems.
  - 2. Aluminum-framed storefront systems as fixed / punched windows.
  - 3. Aluminum-framed entrance door systems.
  - 4. Exterior Sun Control Devices
  - 5. Aluminum Sill Flashing and Stools

# 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
  - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
  - 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
    - a. Joinery, including concealed welds.
    - b. Anchorage.
    - c. Expansion provisions.
    - d. Glazing.
    - e. Flashing and drainage.
  - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
  - 4. Include point-to-point wiring diagrams showing the following:
    - a. Power requirements for each electrically operated door hardware.
    - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

# 1.4 QUALITY ASSURANCE

- A. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- B. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems that include structural glazing.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

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

# 2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.
    - e. Failure of operating units.
- B. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings .
- C. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
  - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches .
  - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces

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edge clearance between framing members and glazing or other fixed components to less than  $1/8 \ \text{inch}$  .

- a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
- 3. Cantilever Deflection: Limited to 2l/175 at unsupported cantilevers.
- D. Structural: Test according to ASTM E330/E330M as follows:
  - 1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
  - 2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
  - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Structural-Sealant Joints:
  - 1. Designed to carry gravity loads of glazing.
- F. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, aluminum-framed entrances and storefronts without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
  - 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
  - 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

# 2.3 STOREFRONT SYSTEMS

- A. <u>Products:</u> Subject to compliance with requirements, provide the following:
  - 1. Kawneer; 451T with High-Perfomance Sills
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
  - 1. Exterior Framing Construction: Thermally broken .
  - 2. Interior Vestibule Framing Construction: Nonthermal .
  - 3. Glazing System: Retained mechanically with gaskets on four sides .
  - 4. Glazing Plane: Center .
  - 5. Finish: Clear anodic finish .
  - 6. Fabrication Method: Field-fabricated stick system.
  - 7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  - 8. Steel Reinforcement: As required by manufacturer.

- C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Accessories: Continuous trim matching storefront material and finish in shapes indicated on the drawings.

# 2.4 ENTRANCE DOOR SYSTEMS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
  1. Kawneer North America, an Arconic company.
- B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
  - 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
  - 2. Door Design: Wide stile; 5-inch nominal width .
    - a. Bottom Rail: 10" minimum for ADA entrance requirements.
  - 3. Glazing Stops and Gaskets: Square , snap-on, extruded-aluminum stops and preformed gaskets.
    - a. Provide nonremovable glazing stops on outside of door.
  - 4. Finish: Match adjacent storefront framing finish.
- 2.5 ENTRANCE DOOR HARDWARE
  - A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."
- 2.6 GLAZING
  - A. Glazing: Comply with Section 08 80 00 "Glazing."
  - B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
  - C. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
    - 1. Color: Match structural sealant.

- 2.7 MATERIALS
  - A. Sheet and Plate: ASTM B209.
  - B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
  - C. Structural Profiles: ASTM B308/B308M.
  - D. Steel Reinforcement:
    - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
    - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
    - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
  - E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
  - F. Exterior Sun Control Devices: : Kawneer Aluminum Sunshade Systems, including accessories, mountings, and shims, anchored directly to the vertical or storefront mullions.
    - 1. 30" Square Outrigger: Planar style louver and five feet mullion spacing.
      - a. The assembled sunshade shall be capable of supporting the specified combined load without damage, permanent deformation, or disengagement from the glazed system mullion.
      - b. Blade deflection shall not exceed L/120 of span length.
      - c. Submit test reports verifying compliance with each test requirement required by the project.
    - 2. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
      - a. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
    - 3. Finishes: Kawneer Permanodic<sup>™</sup> AA-M10C21A31, AAMA 611, Architectural Class II Clear Anodic Coating (Color #17 Clear).

## 2.8 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
  - 3. Use exposed fasteners with countersunk Phillips screw heads , finished to match framing system , fabricated from 300 series stainless steel.
- B. Sealants:
  - 1. Dow Dowsil 795 Silicone Building Sealant Anodized Aluminum.

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- a. Durometer: 25 Shore A
- b. Tensile Strength: 125 PSI
- c. Elongation: 450%
- d. Tear: 20 lbs/inch.
- 2. Backer Rod: Closed-cell, non-absorbent, moisture resistant backer rod compatible with sealant indicated by manufacturer for use in aluminum storefront systems as indicated on the drawings.
  - a. Density: 1.5 per ASTM D1622
  - b. Tensile Strength: 24 psi min per ASTM D1623
  - c. Water Absorption: 0.03 gm/cc per ASTM C1016
  - d. Classification: Type 3 (ASTM D5249), Type C (ASTM C1330)
  - e. Diameter: Sized for compression into joints for widths indicated.
    - 1) Provide 5/8" rod diameter at 3/8"-1/2" design joints or as indicated by manufacturer's written requirements.

# 2.9 FABRICATION

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

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- 2. At exterior doors, provide weather sweeps applied to door bottoms.
- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
- 2.10 ALUMINUM FINISHES
  - A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

- 3.1 EXAMINATION
  - A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - B. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION, GENERAL
  - A. Comply with manufacturer's written instructions.
  - B. Do not install damaged components.
  - C. Fit joints to produce hairline joints free of burrs and distortion.
  - D. Rigidly secure nonmovement joints.
  - E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
  - F. Seal perimeter and other joints watertight unless otherwise indicated.
  - G. Metal Protection:
    - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
    - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
  - H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.

- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

# 3.3 INSTALLATION OF OPERABLE UNITS

A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

# 3.4 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 08 80 00 "Glazing."
- 3.5 INSTALLATION OF STRUCTURAL GLAZING
  - A. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
  - B. Set glazing into framing according to sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
  - C. Set glazing with proper orientation so that coatings face exterior or interior as specified.
  - D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
  - E. Apply structural sealant to completely fill cavity, according to sealant manufacturer and framing manufacturer's written instructions and in compliance with local codes.
  - F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
  - G. Allow structural sealant to cure according to manufacturer's written instructions.
  - H. Clean and protect glass as indicated in Section 08 80 00 "Glazing."

## 3.6 INSTALLATION OF WEATHERSEAL SEALANT

- A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.
- B. Install weatherseal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.
- 3.7 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS
  - A. Install entrance doors to produce smooth operation and tight fit at contact points.

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- 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
- 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

# 3.8 ERECTION TOLERANCES

- A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
  - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
  - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
  - 3. Alignment:
    - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
  - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 08 41 13

#### SECTION 08 56 19 - PASS WINDOWS

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. This section includes:
    - 1. Frameless interior pass-thru sliding service windows as indicated in drawings and in sections.
- 1.2 RELATED REQUIREMENTS
  - A. C. Glass and Glazing: Section 08 8 0 .00, GLAZING.

#### 1.3 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Submit for fabrication and installation of windows. Include details, elevations and installation requirement of finish hardware and cleaning.
- C. Product Data: Submit Manufacturer's technical product data substantiating that products comply, and installation instructions.
- D. Samples: Exposed finishes. 4" (102 mm) piece of each color.
- E. Sustainable Construction Submittals: Recycled content. Identify post-consumer and preconsumer recycled content percentage by weight.
- 1.4 DELIVERY, STORAGE, AND HANDLING
  - A. Deliver windows crated to provide protection during transit and job storage.
  - B. Inspect windows upon delivery for damage. Unless minor defects can be made to meet the Architect's specifications and satisfaction, damaged parts should be removed and replaced.
  - C. Store windows at building site under cover in dry location.
  - D. Protect products from damage during handling and construction operations.
- 1.5 WARRANTY
  - A. Warranty: All material and workmanship shall be warranted against defects for a period of one (1) year from the original date of purchase.

## PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Header: Shall be constructed of 6063-T5 extruded aluminum. Window rolls on top-hung ball bearing rollers. Overall size is to be in accordance with the contract drawings.
- B. Finish: All aluminum to be brite anodized, satin anodized, or bronze anodized (Specify).
- C. Glazing: The glazing is to be 9/16" (laminated safety glass) in thickness.
- D. Options: Keyed lock, push button lock, fixed sidelite header insert, recessed bottom track.

## 2.2 PRODUCTS GENERAL

- A. Basis of design: Design is based on Continental Style Security Rolling Track Pass-Thru Window manufactured by:
  - 1. C.R. Laurence Co., Inc. (800) 421-6144 Ext. 7760

#### 2.3 PASS WINDOWS

- A. Pass Window Units: Factory fabricated, glazed unit; horizontal sliding type.
  - 1. Header: Extruded aluminum.
  - 2. Glass: Safety type specified in Section 08 8 0 .00, GLAZING.
  - 3. Hardware: Manufacturer's standard double track header, rollers, guides, push button lock.

# PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Verify rough opening is properly sized and located.
- C. Protect existing construction and completed work from damage.
- D. Apply barrier coating to aluminum surfaces in contact with dissimilar metals and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

# 3.2 INSTALLATION

A. Install window in accordance with manufacturer's printed instructions and recommendations. Repair damaged units as directed (if approved by the manufacturer and the architect) or replace with new units.

# 3.3 CLEANING

- A. A. Clean frame and glazing surfaces after installation, complying with requirements contained in the manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances.
- 3.4 PROTECTION
  - A. A. Institute protective measures required throughout the remainder of the construction period to ensure that all the windows do not incur any damage or deterioration, other than normal weathering, at the time of acceptance.

END OF SECTION 08 56 19

# SECTION 08 71 00 – DOOR HARDWARE

#### 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. 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. Division 01 Section "Alternates" for alternates affecting this section.
  - 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
  - 3. Division 26 sections for connections to electrical power system and for low-voltage wiring.
  - 4. Division 28 sections for coordination with other components of electronic access control system.

#### 1.03 REFERENCES

A. UL - Underwriters Laboratories

#### DOOR HARDWARE

- 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 or sample installations of each type of exposed 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.
- I. 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.
  - 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. Certificates of Compliance:
  - a. UL listings for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
  - b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.
  - c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
- 4. 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. Requirements of Regulatory Agencies:
  - 1. Furnish finish hardware to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications.
  - 2. Furnish finish hardware to comply with the requirements of the regulations for public building accommodations for physically handicapped persons of the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.
  - 3. Provide hardware for fire rated openings in compliance with NFPA 80 and state and local building code requirements. Provide only hardware that has been tested and listed by UL for types and sizes of doors required and complies with requirements of door and door frame labels.
- B. Supplier:
  - 1. Mechanical Hardware

- a. Shall be an established firm dealing in contract builders' hardware. Distributor must have adequate inventory, qualified personnel on staff and be located within 100 miles of the project. The distributor must be a factory-authorized dealer for all materials required. The supplier shall be or have in employment an Architectural Hardware Consultant (AHC).
- b. Door Hardware distributor/supplier listed on the Bid Form shall be a factory authorized distributor for the hardware specified. This requirement will not be allowed to be med by a non-factory authorized dealer subcontracting to a factory authorized dealer. Any submitted bid that attempts to circumvent this requirement will be considered non-response and will be removed from consideration.
- 2. Electrified Hardware:
  - a. Shall be an experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful inservice performance, and who is acceptable to manufacturer of primary materials. The supplier must be a factory-authorized distributor for all materials required.
  - b. Shall prepare 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.
  - c. Shall have experience in providing consulting services for electrified door hardware installations.
- C. Installer Qualifications:
  - 1) Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. 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).
  - 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.
- E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- F. 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 firerated door and door frame labels.
- G. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

- H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
- I. 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.
  - 2. Attendees of Keying Conference: Owner, Contractor, Architect, Installer, Owner's security consultant and Supplier's Architectural Hardware Consultant.
- J. 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.
- K. 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.

# 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, access control, and keying 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.

## 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: 10 years.
    - b. Automatic Operators: 2 years.
    - c. Exit Devices:
      - 1) Mechanical: 3 years.
      - 2) Electrified: 1 year.
    - d. Locksets:
      - 1) Mechanical: 10 years.
      - 2) Electrified: 1 year.
    - e. Continuous Hinges: Lifetime warranty.
    - f. 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.

#### 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. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
  - 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- C. 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.
- D. 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. 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 (ECBB series not approved), McKinney TA/T4A series (MacPro series not approved).

#### B. Requirements:

- 1. Provide hinges conforming to ANSI/BHMA A156.1.
- 2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
  - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
  - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
- 3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
  - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 4. 2 inches or thicker doors:
  - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
- 6. 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
- 7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.

## 2.04 CONTINUOUS HINGES

- A. Aluminum Geared
  - 1. Manufacturers:
    - a. Scheduled Manufacturer: lves.
    - b. Acceptable Manufacturers: Pemko, Select.

#### DOOR HARDWARE

## 2. Requirements:

- a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
- b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
- c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
- d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
- e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
- f. Install hinges with fasteners supplied by manufacturer.
- g. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

# 2.05 ELECTRIC POWER TRANSFER

- A. Manufacturers:
  - a. Scheduled Manufacturer: Von Duprin EPT-10.
  - b. Acceptable Manufacturers: Precision EPT-12C, Securitron CEPT-10.
- B. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.
- C. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

## 2.06 FLUSH BOLTS

- A. Manufacturers:
  - 1. Scheduled Manufacturer: lves.
  - 2. Acceptable Manufacturers: Burns, Rockwood.
- B. Requirements:
  - Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

## 2.07 COORDINATORS

A. Manufacturers:

- 1. Scheduled Manufacturer: lves.
- 2. Acceptable Manufacturers: Rockwood, Trimco.
- B. Requirements:
  - 1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
  - 2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

## 2.08 MORTISE LOCKS

- A. Manufacturers and Products:
  - 1. Scheduled Manufacturer and Product: Falcon MA series.
  - 2. Acceptable Manufacturers and Products: BEST 40H, Sargent 8200 series.
- B. Requirements:
  - 1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3 hour fire doors.
  - 2. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
  - 3. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
  - 4. Verify lock functions with owner prior to ordering.
  - 5. Install thumb turns so they are in vertical position when doors are unlocked and in horizontal position when doors are locked.
  - 6. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
  - 7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
  - 8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
    - a. Lever Design: Falcon Quantum-Gala.
    - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

## 2.09 CYLINDRICAL LOCKS - GRADE 1

- A. Manufacturers and Products:
  - 1. Scheduled Manufacturer and Product: Falcon T series.
  - 2. Acceptable Manufacturers and Products: BEST 9K, Sargent 10-Line.
- B. Requirements:

DOOR HARDWARE

DOOR HARDWARE 08 71 00 - 12 arcDESIGN, PC

- 1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
- 2. Cylinders: Refer to "KEYING" article, herein.
- 3. Verify lock functions with owner prior to ordering.
- 4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
- 5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
- 6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
- 7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
- 8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
  - a. Lever Design: Falcon Quantum
  - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

# 2.10 AUXILIARY LOCKS

- A. Deadbolts:
  - 1. Manufacturers and Products:
    - a. Scheduled Manufacturer and Product: Falcon D100 Series.
    - b. Acceptable Manufacturers and Products: Best 8T3 Series, Corbin-Russwin DL3000 Series, Schlage B600 Series.
  - 2. Requirements:
    - a. Provide deadbolt series conforming to ANSI/BHMA A156 and function as specified.
    - b. Cylinders: Refer to "KEYING" article, herein.
    - c. Provide deadbolts with standard 2-3/4 inches (70 mm) backset. Provide 2-3/8 inches (60 mm) where noted or if door or frame detail requires. Provide deadbolt with full 1 inch (25 mm) throw, constructed of steel alloy.
    - d. Provide manufacturer's standard strike.

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

- A. Manufacturers:
  - 1. Scheduled Manufacturer and Product: Schlage NDEB series By Owner's Security Contractor
  - 2. Acceptable Manufacturers and Products: No substitute.
- B. 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.

DOOR HARDWARE 08 71 00 - 13 arcDESIGN, PC

- Compliant with ANSI/BHMA A156.25 Operation and Security interior operating range of 32 degrees F (0 degrees C) to 120 degrees F(49 degrees 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. Emergency Override: Provide mechanical key override; cylinders: Refer to "KEYING" article, herein.
- 10. 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 and is field reversible without tools.
  - c. Style: Schlage Sparta
- 11. 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.
- 12. 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.
  - d. Suitable for both interior and exterior deployment.
  - e. Employ Wi-Fi communications to permit remote view of audits and alerts, as well as provide automatic daily updates to lock configuration and user access rights.
- 13. Adaptability:
  - a. Open Architecture: Provide locksets manufactured with open architecture characteristics capable of handling new and existing access control software and credential reading technology. Can be supported by cloud-based web and mobile apps without the need for an integrated software partner.
- 14. 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

- e. Interior Push Button
- 15. Credentials: Provide integral credential reader modules in the following configurations:
  - a. NFC, including peer-peer compatible, operable with both Android and IOS mobile devices
  - b. 125 kHz contactless smart cards
    - 1) Compatibility: Schlage, XceedID, ISONAS, HID, GE/CASI, AWID
  - c. 13.56 MHz contactless smart cards
    - 1) Secure section (multi-technology and smart card) compatibility: Schlage MIFARE Classic, Schlage MIFARE DESFire EV1
    - 2) 13.56 MHz Serial number only (multi-technology and smart card) compatibility: DESFire CSN, HID iCLASS CSN, MIFARE CSN, MIFARE DESFire EV1 CSN
  - d. Multi-technology contactless for applications requiring read capability for both 125 kHz proximity and 13.56 MHz contactless smart cards.
  - e. BLE
- 16. Records: Subject to the limitations of the attached access control system, the wireless locks possess enough storage capacity to support 5000 users and 2000 audits.
- 17. Verification time: less than or equal to 1 second for smart cards and proximity cards
- 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.

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- 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.

## 2.12 EXIT DEVICES

- A. Manufacturers and Products:
  - 1. Scheduled Manufacturer and Product: Von Duprin 98/35A series.
  - 2. Acceptable Manufacturers and Products: Precision APEX 2000 series.
- B. Requirements:
  - 1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
  - 2. Cylinders: Refer to "KEYING" article, herein.
  - 3. Verify exit device functions with owner prior to ordering.
  - 4. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
  - 5. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
  - 6. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
  - 7. Provide flush end caps for exit devices.
  - 8. Provide exit devices with manufacturer's approved strikes.

- 9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
- 10. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
- 11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
- 12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
- 13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
- 14. Provide electrified options as scheduled.
- 15. Concealed Vertical Cable Exit Devices: provide cable-actuated concealed vertical latch system in two-point for non-rated or fire rated wood doors up to a 90 minute rating and less bottom latch (LBL) configuration for non-rated or fire rated wood doors up to 20 minute rating. Vertical rods not permitted.
  - a. Cable: Stainless steel with abrasive resistant coating. Conduit and core wire ends snap into latch and center slides without use of tools.
  - b. Wood Door Prep: Maximum 1 inch x 1.1875 inch x 3.875 inches top latch pocket and 1 inch x 1.1875 inch x 5 inches bottom latch pocket which does not require the use of a metal wrap or edge for non-rated or fire rated wood doors up to a 45 minute rating.
  - c. Latchbolts and Blocking Cams: Manufactured from sintered metal low carbon copperinfiltrated steel, with molybdenum disulfide low friction coating.
  - d. Top Latchbolt: Minimum 0.38 inch (10 mm) and greater than 90 degree engagement with strike to prevent door and frame separation under high static load.
  - e. Bottom Latchbolt: Minimum of 0.44 inch (11 mm) engagement with strike.
  - f. Product Cycle Life: 1,000,000 cycles.
  - g. Latch Operation: Top and bottom latch operate independently of each other. Top latch fully engages top strike even when bottom latch is compromised. Separate trigger mechanisms not permitted.
  - h. Latch release does not require separate trigger mechanism.
  - i. Cable and latching system characteristics:
    - 1) Installed independently of exit device installation, and capable of functioning on door prior to device and trim installation.
    - 2) Connected to exit device at single point in steel and aluminum doors, and two points for top and bottom latches in wood doors.
    - 3) Bottom latch height adjusted, from single point for steel and aluminum doors and two points for wood doors, after system is installed and connected to exit device, while door is hanging
    - 4) Bottom latch position altered up and down minimum of 2 inches (51 mm) in steel and aluminum doors without additional adjustment. Bottom latch deadlocks in every adjustment position in wood doors.
    - 5) Top and bottom latches in steel and aluminum doors and top latch in wood doors may be removed while door is hanging.
- 16. Top latch mounting: double or single tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
- 17. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
  - a. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

## 2.13 ACCESS CONTROL READER

- A. Manufacturers and Products:
  - 1. Scheduled Manufacturer and Product: Scheduled Manufacturer and Product:
    - a. Schlage MT11/ MT15 By Owner's Security Contractor
  - 2. Acceptable Manufacturers and Products:
    - a. No Substitute
- B. Requirements: Read Only Multi-technology Contactless reader
  - 1. Provide access control card readers manufactured by a global company who is a recognized leader in the production of access control devices. Card reader manufactured for non-access control applications are not acceptable
  - Provide multi-technology contactless readers which can read access control data from both 125 kHz and 13.56 MHz contactless smart cards and NFC-compatible. Provide multi-technology contactless reader optimally designed for use in access control applications that require reading both 125 kHz Proximity and 13.56 MHz contactless smart cards by providing:
    - a. Configuration allows reader to be enabled to read smart, proximity or both technologies at the same time.
    - b. A migration platform to upgrade from the most popular 125 kHz proximity technologies to MIFARE or MIFARE DESFire EV1 by reading both 125 kHz proximity technology and 13.56 MHz contactless smart card technology.
    - c. Guaranteed compatibility to read all standard data formats ensuring card-to-reader interoperability in multi-location installations and multi-card/reader populations.
    - d. Secure access control data exchange between the smart card and the reader utilizing diversified keys and mutual authentication sequences.
    - e. Universal compatibility with most access control systems.
    - f. Ease of installation through industry standard wiring methods.
    - g. Compatibility with legacy 125 KHz proximity access control formats (all standard formats up to 37 bits, including HID Corporate 1000 formats).
    - h. Optimal read range and read speed for increased access control throughput.
    - i. Global availability.
    - j. Product construction suitable for both indoor and outdoor applications.
    - k. Customizable behavior for indicator lights and beeper.
  - 3. Provide multi-technology contactless readers complying with the following 13.56MHzrelated standards to ensure product compatibility and predictability of performance:
    - a. ISO 14443
  - 4. Provide multi-technology contactless readers configurable to read 13.56 MHz data simultaneously from the following cards (multiple credential support based on reader configuration):
    - a. Secure support Mifare DESFire EV1with PACSA, Mifare Classic, FIPS 201 PIV Credential.
    - b. UID/CSN Support DESFire Classic V0.06, HID iClass, ISOX (my-d).
    - c. Proximity Schlage Proximity, XID Proximity, HID Prox, AWID, GE/CASI, Lenel Prox, Inside Pictotag, TI Tagit, ST Micro.

- 5. Provide multi-technology contactless readers configurable to read data from any compatible 125 kHz technology simultaneously with 13.56 MHz data. Compatible 125 kHz technologies include:
  - a. XCEEDID/Schlage/HID Prox (format in the card formats up to 37-bits supported).
  - b. AWID PROX (SAME AS LENEL PROX format in the card formats up to 42-bits).
  - c. GE PROX two possible format options.
- 6. Provide multi-technology contactless readers with the ability to read card access data stored in the secure access control sector/application area of the ISO 14443 XceedID MIFARE or MIFARE DESFire EV1 card.
- 7. Provide multi-technology contactless readers configurable to provide multiple hierarchical degrees of key compatibility for accessing the smart card access control data. Provide compatibility for the following key structure options:
  - a. Compatibility with the default manufacture's key structure to ensure convenient off the shelf compatibility with manufacture's cards and readers.
  - b. Compatibility with custom keys managed by manufacturer which provide a sitespecific, unique, protected key structure.
  - c. Compatibility with high security customer managed custom keys.
- 8. Provide multi-technology contactless readers configurable to provide compatibility with all standard Prox formats up to 37 bits (including Corporate 1000<sup>®</sup>).
- 9. Provide multi-technology contactless readers which allow the reader firmware to be upgraded in the field without the need to remove the reader from the wall through the use of factory-provided device.
- 10. Provide multi-technology contactless readers suitable for global deployment by meeting worldwide radio and safety regulatory compliance including:
  - a. FCC Certification (US)
  - b. CE (EU)
  - c. C-tick (Australia, New Zealand)
  - d. R&TTE Directive (15EU)
  - e. UL294 (US)
  - f. ULC-S319
  - g. IC (Canada)
  - h. FIPS201 / PIV I
  - i. IP65
- 11. Provide multi-technology contactless readers fully compliant with Restriction of Hazardous Substances directive (RoHS) restricting the use of specific hazardous materials found in electrical and electronic products.
- 12. Provide multi-technology contactless readers with universal compatibility with most access control systems by outputting card data in compliance with the SIA AC-01 Wiegand standard.
- 13. Provide multi-technology contactless readers with tamper resistant screws.
- 14. Provide multi-technology contactless readers with the ability to transmit an alarm signal via and integrated optical tamper switch if an attempt is made to remove the reader from the wall. Provide tamper switch programmable to provide a selectable action to provide a selectable action compatible with various tamper communication schemes provided by access control panel manufacturers. The selectable action must include one of the following:

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- a. The reader open collector line changes from a high state (5V) to a low state (Ground).
- b. If utilizing OSDP, provide protocol reader reporting a tamper condition via RS485.
- 15. Provide multi-technology contactless readers with the ability to mount to standard electrical boxes using universal international mounting holes.
- 16. Provide multi-technology contactless readers with a full potted assembly.
- 17. Provide multi-technology contactless readers with a quick connect wire harness.
- 18. Provide multi-technology contactless readers with customizable reader behavior options either from the factory, or defined in the field using pre-configured command cards. Reader behavior programming options must include:
  - a. LED & Audio configurations.
  - b. Ability to disable reading of specific card technologies or frequencies.
  - c. ISO 14443/15693 CSN output configuration.
  - d. Wiegand output spacing and timing.
- 19. Provide multi-technology contactless readers with the following programmable audio/visual indication:
  - a. Provide an audio beeper tone sequence to signify: access granted, access denied, power up, and diagnostics.
  - b. Provide a light bar with clear visual status (red/green/amber).
- 20. Provide multi-technology contactless readers designed for low current operation to enable migration from most legacy proximity applications without the need to replace existing access control panels and/or power supplies. Provide contactless smart cards with the following power requirements:
  - a. Operating voltage: 5 16 VDC, reverse voltage protected. Linear power supply recommended.
  - b. Current requirements: 125 mA DC, 140 mA PEAK @ 12 VDC
- 21. Provide multi-technology contactless readers meeting the following physical specifications:
  - a. Dimensions: 5.91" x 1.72" x 0.84" (15 cm x 4.4 cm x 2.1cm)
  - b. Weight: 9.6 oz. (272.15 g)
  - c. Material: UL94 Polycarbonate
  - d. Plastics: Consist of three-piece design with mounting plate, potted case and aesthetic cover.
  - e. Color: Black, Gray, Brown or Cream as approved by the project architect.
- 22. Provide multi-technology contactless readers meeting the following environmental specifications:
  - a. Operating temperature: -31 to 151 degrees F (-35 to 67 degrees C)
  - b. Operating humidity: 5% to 95% relative humidity non-condensing
  - c. Weatherized design suitable to withstand harsh environments1) Certified rating of IP65
- 23. Multi-technology contactless reader cabling requirements:
  - a. Cable distance: (Wiegand): 500 feet (150m)
  - b. Cable type: 5-conductor #22 AWG

c. Standard reader termination: 18" (0.5m) wire harness

## 2.14 ELECTRIC STRIKES

- A. Manufacturers and Products:
  - 1. Scheduled Manufacturer and Product: Von Duprin 6000 Series.
  - 2. Acceptable Manufacturers and Products: Folger Adam 300 Series, HES 1006 Series.
- B. Requirements:
  - 1. Provide electric strikes designed for use with type of locks shown at each opening.
  - 2. Provide electric strikes UL Listed as burglary-resistant.
  - 3. Where required, provide electric strikes UL Listed for fire doors and frames.
  - 4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

## 2.15 POWER SUPPLIES

- A. Manufacturers and Products:
  - 1. Scheduled Manufacturer and Product: Schlage or Von Duprin PS900 series
  - 2. Acceptable Manufacturers and Products: Precision ELR series, Securitron BPS series
- B. Requirements:
  - 1. Provide power supplies, recommended and approved by manufacturer of electrified locking component, for operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring power supply.
  - 2. Provide appropriate quantity and size of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
  - Provide appropriate option boards for power supplies necessary for proper operation of the electrified locking components as recommended by the manufacturer of the electrified locking components with consideration for each electrified component used in the system.
  - 4. Provide regulated and filtered 24 VDC power supply and UL class 2 listed.
  - 5. Options:
    - a. Provide power supply, where specified, with internal capability of charging sealed backup batteries 24 VDC, in addition to operating DC load.
    - b. Provide sealed batteries for battery back-up at each power supply where specified.
    - c. Provide keyed power supply cabinet.
  - 6. Provide power supply in an enclosure, complete, and requiring 120VAC to fused input.
  - 7. Provide power supply with emergency release terminals, where specified, that allow release of all devices upon activation of fire alarm system complete with fire alarm input for initiating "no delay" exiting mode.

## 2.16 CYLINDERS

- A. Manufacturers:
  - **1.** Scheduled Manufacturer: Falcon
  - 2. Acceptable Manufacturers: ASSA, Best, Corbin-Russwin, Medeco, Sargent, Yale
- B. Requirements:
  - Provide cylinders/cores, from the same manufacturer of locksets, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; 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. Cylinder/Core Type: Small Format Interchangeable Core (SFIC)
  - 3. Nickel silver bottom pins.
  - 4. Replaceable Construction Cores.
    - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
      - 1) 2 construction control keys.
      - 2) 12 construction change (day) keys.

## 2.17 KEYING

- A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Requirements:
  - 1. Provide keying system capable of multiplex masterkeying.
  - 2. Permanent cylinders/cores keyed by the manufacturer according to the following key system.
    - a. Keying system as directed by the Owner.
    - b. (Great)Grand Master Key System: Cylinders/cores operated by change (day) keys and subsequent masters (including grand/great grand) keys.
  - 3. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
  - 4. Provide keys with the following features:
    - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm).
  - 5. Identification:
    - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
    - b. Identification stamping provisions must be approved by the Architect and Owner.

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- c. Stamp keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE".
- d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
- e. Verify with owner if permanent cylinders/cores and/or keys are to be shipped directly to Owner or to Contractor.
- 6. Quantity: Furnish in the following quantities.
  - a. Change (Day) Keys: 3 per cylinder/core.
  - b. Permanent Control Keys: 3 (if required).
  - c. Master Keys: 6 per master.
  - d. Unused balance of key blanks shall be furnished to Owner with the cut keys.

## 2.18 KEY CONTROL SYSTEM

- A. Manufacturers:
  - 1. Scheduled Manufacturer: Telkee.
  - 2. Acceptable Manufacturers: HPC, Lund.
- B. Requirements:
  - 1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
    - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
    - b. Provide hinged-panel type cabinet for wall mounting.

## 2.19 DOOR CLOSERS

- A. Manufacturers and Products:
  - 1. Scheduled Manufacturer and Product: Falcon SC70A series.
  - 2. Acceptable Manufacturers and Products: LCN 4050 series, Norton 7500 series, Sargent 351 series.
- B. Requirements:
  - 1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
  - 2. Provide door closers with fully hydraulic, full rack and pinion action with aluminum cylinder.
  - 3. Closer Body: 1-1/2 inch (38 mm) diameter with 5/8 inch (16 mm) diameter heat-treated pinion journal.
  - 4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees 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.

# 2.20 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

- A. Manufacturers and Products:
  - 1. Scheduled Manufacturer and Product: LCN 4600 series.
  - 2. Acceptable Manufacturers and Products: Norton 6000 series, Precision D4990 series.
- B. Requirements:
  - 1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
  - 2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
  - 3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
  - 4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
  - 5. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check valve, sweep valve, latch valve to control door.
  - 6. Provide drop plates, brackets, or adapters for arms as required for details.
  - 7. Provide hard-wired actuator switches for operation as specified.
  - 8. Provide weather-resistant actuators at exterior applications.
  - 9. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
  - 10. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
  - 11. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

# 2.21 DOOR TRIM

- A. Manufacturers:
  - 1. Scheduled Manufacturer: lves.
  - 2. Acceptable Manufacturers: Rockwood, Trimco.

- B. Requirements:
  - Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
  - 2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
  - 3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
  - 4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
  - 5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
  - 6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
  - 7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
  - 8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

# 2.22 PROTECTION PLATES

- A. Manufacturers:
  - 1. Scheduled Manufacturer: lves.
  - 2. Acceptable Manufacturers: Rockwood, Trimco.
- B. Requirements:
  - 1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (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 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
    - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
    - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

# 2.23 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

- A. Manufacturers:
  - 1. Scheduled Manufacturers: Glynn-Johnson.
  - 2. Acceptable Manufacturers: ABH, Dorma.
- B. Requirements:
  - 1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.

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- 2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
- 3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
- 4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

## 2.24 DOOR STOPS AND HOLDERS

- A. Manufacturers:
  - 1. Scheduled Manufacturer: lves.
  - 2. Acceptable Manufacturers: Rockwood, Trimco.
- 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.

# 2.25 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.
  - 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: 1/2 inch (13 mm) high by jamb width by door width
    - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (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.

## 2.26 SILENCERS

- A. Manufacturers:
  - 1. Scheduled Manufacturer: lves.
  - 2. Acceptable Manufacturers: Rockwood, Trimco.
- B. Requirements:
  - 1. Provide "push-in" type silencers for hollow metal or wood frames.
  - 2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
  - 3. Omit where gasketing is specified.

#### 2.27 DOOR POSITION SWITCHES

- A. Manufacturers:
  - 1. Scheduled Manufacturer: Schlage.
  - 2. Acceptable Manufacturers: GE-Interlogix.
- B. Requirements:
  - 1. Provide recessed or surface mounted type door position switches as specified.
  - 2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches between switch and magnetic locking device.

## 2.28 FINISHES

A. Provide finish for each item as indicated in the sets.

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

#### 3.02 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."
  - 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- 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 inches (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. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
  - 1. Conduit, junction boxes and wire pulls.
  - 2. Connections to and from power supplies to electrified hardware.
  - 3. Connections to fire/smoke alarm system and smoke evacuation system.
  - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
  - 5. Testing and labeling wires with Architect's opening number.
  - 6. Connections to panel interface modules, controllers and gateways
- J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- K. 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.

- L. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- O. 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.
- P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- R. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

## 3.03 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
  - 1. Architectural Hardware Consultant 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.

## 3.04 FIELD INSPECTIONS:

- A. Fire Door Assembly Inspection and Testing: Provide functional testing and inspection of fire door assemblies in accordance with NFPA 80-2007/2010. Inspections shall be performed by individuals certified by Intertek as a Fire Door Assembly Inspector, using reporting forms provided by the Door and Hardware Institute (DHI). Alternatively, inspections may be performed by individuals acceptable to the Architect, who have knowledge and understanding of the operating components of the applicable door type, and who have experience in preparing written reports of testing and inspection results.
  - 1. Schedule fire door assembly inspection within 90 days of Substantial Completion of the Project.
  - 2. Submit a signed, written final report as specified in Paragraph 1.4: Submittals.
  - 3. Contractor shall correct all deficiencies and schedule a reinspection of fire door assemblies which were noted as deficient on the inspection report.
  - 4. Inspector shall reinspect fire door assemblies after repairs are made.
  - 5. Additional reinspections which are required due to incomplete repairs will be performed by the inspector at the expense of the Contractor.
- B. Provide inspection of required egress door assemblies by a qualified person in accordance with NFPA 101.

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- 1. Schedule egress door assembly inspection within 90 days of Substantial Completion of the Project for the required openings.
- 2. Submit a signed, written final report as specified in Paragraph 1.03.E.2.
- 3. Correct all deficiencies and schedule a reinspection of egress door assemblies noted as deficient on the inspection report.
- 4. Inspector to reinspect required egress door assemblies after repairs are made.

## 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. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - 2. 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 DEMONSTRATION

A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

#### 3.08 DOOR HARDWARE SCHEDULE

- A. 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. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in

a hardware set should be scheduled with the appropriate additional hardware required for proper application.

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

65153 OPT0242721 Version 1

#### HARDWARE GROUP NO. 01

FOR USE ON DOOR #(S): 101A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<u>FINISH</u>	<u>MFR</u>
2	EA	CONT. HINGE	112XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9849-EO 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9849-NL-OP-110MD 24 VDC	626	VON
1	EA	RIM CYLINDER	C953-7CCA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
2	EA	90 DEG OFFSET PULL	8190HD 10" A	630	IVE
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	SURF. AUTO OPERATOR	4642 TBWMS 120 VAC	689	LCN
1	EA	WEATHER RING	8310-801		LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T	630	LCN
1	EA	TOP RAIL DROP PLATE	SC70-18PA (AS REQ)	689	FAL
1	EA	CUSH SHOE SUPPORT	SC70-30 (AS REQ)	689	FAL
1	EA	BLADE STOP SPACER	SC70-61 (AS REQ)	689	FAL
1	EA		WEATHERSTRIP BY DOOR/FRAME MFR		B/O
2	EA	DOOR SWEEP	39A	А	ZER
1	EA	THRESHOLD	655A	А	ZER
1	EA	MULTITECH READER	MT15 [BY OWNER'S SECURITY CONTRACTOR]	BLK	SCE
2	EA	DOOR CONTACT	7764	628	SCE
1	EA	POWER SUPPLY	PS904 900-4RL [COORDINATE WITH ACCESS CONTROL PROVIDER]	LGR	SCE
1	EA	DIAGRAM	ELEVATION		DLR
1	EA	DIAGRAM	POINT TO POINT		DLR
OPERA		OORS NORMALLY CLOSED A	ND LOCKED VALID CREDENTIAL MI		

OPERATION: DOORS NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ACCESS AND ACTIVATES EXTERIOR ACTUATOR. WHEN ACTIVE, PRESSING EXTERIOR ACTUATOR CYCLES AUTOMATIC OPERATOR AND MOMENTARILY OPENS DOOR. INTERIOR ACTUATOR ALWAYS ACTIVE. DOORS REMAIN CLOSED UPON LOSS OF POWER. DOOR CONTACTS TO MONITOR DOOR POSITION. RX SWITCH (INTEGRAL TO PANIC DEVICE) SHUNTS DOOR CONTACTS FOR VALID EGRESS. FREE EGRESS AT ALL TIMES.

DOORS CAN BE LEFT UNLOCKED AS PROGRAMMED BY ACCESS CONTROL.

# HARDWARE GROUP NO. 02

FOR USE ON DOOR #(S): 133A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<b>DESCRIPTION</b>	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>		
2	EA	CONT. HINGE	112XY EPT	628	IVE		
2	EA	POWER TRANSFER	EPT10	689	VON		
1	EA	ELEC PANIC HARDWARE	RX-QEL-9849-EO 24 VDC	626	VON		
1	EA	ELEC PANIC HARDWARE	RX-QEL-9849-NL-OP-110MD 24 VDC	626	VON		
1	EA	RIM CYLINDER	C953-7CCA	626	FAL		
1	EA	PERMANENT CORE	C607	626	FAL		
2	EA	90 DEG OFFSET PULL	8190HD 10" A	630	IVE		
2	EA	SURFACE CLOSER	SC71A SS	689	FAL		
2	EA	TOP RAIL DROP PLATE	SC70-18PA (AS REQ)	689	FAL		
2	EA	CUSH SHOE SUPPORT	SC70-30 (AS REQ)	689	FAL		
2	EA	BLADE STOP SPACER	SC70-61 (AS REQ)	689	FAL		
1	EA		WEATHERSTRIP BY DOOR/FRAME MFR		B/O		
2	EA	DOOR SWEEP	39A	А	ZER		
1	EA	THRESHOLD	655A	А	ZER		
1	EA	MULTITECH READER	MT15 [BY OWNER'S SECURITY CONTRACTOR]	BLK	SCE		
2	EA	DOOR CONTACT	7764	628	SCE		
1	EA	POWER SUPPLY	PS904 900-4RL [COORDINATE WITH ACCESS CONTROL PROVIDER]	LGR	SCE		
1	EA	DIAGRAM	ELEVATION		DLR		
1	EA	DIAGRAM	POINT TO POINT		DLR		
OPERA	PERATION: DOORS NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY						

UNLOCKS DOOR ALLOWING ACCESS. DOORS REMAIN CLOSED UPON LOSS OF POWER. DOOR CONTACTS TO MONITOR DOOR POSITION. RX SWITCH (INTEGRAL TO PANIC DEVICE) SHUNTS DOOR CONTACTS FOR VALID EGRESS. FREE EGRESS AT ALL TIMES.

DOORS CAN BE LEFT UNLOCKED AS PROGRAMMED BY ACCESS CONTROL.

# HARDWARE GROUP NO. 03

FOR USE ON DOOR #(S): 006

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>
8	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-98-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL 24 VDC	626	VON
1	EA	RIM CYLINDER	C953-7CCA	626	FAL
1	EA	MORTISE CYLINDER HOUSING	C987-7CCA	626	FAL
2	EA	PERMANENT CORE	C607	626	FAL
2	EA	SURFACE CLOSER	SC71A SS	689	FAL
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA	AA	ZER
2	EA	DOOR SWEEP	39A	А	ZER
1	EA	THRESHOLD	655A	А	ZER
1	EA	MULTITECH READER	MT15 [BY OWNER'S SECURITY CONTRACTOR]	BLK	SCE
2	EA	DOOR CONTACT	679-05HM/679-05WD AS REQ'D	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [COORDINATE WITH ACCESS CONTROL PROVIDER]	LGR	SCE
1	EA	DIAGRAM	ELEVATION		DLR
1	EA	DIAGRAM	POINT TO POINT		DLR

OPERATION: DOORS NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS ACTIVE DOOR LEAF ALLOWING ACCESS. DOORS REMAIN CLOSED UPON LOSS OF POWER. DOOR CONTACTS TO MONITOR DOOR POSITION. RX SWITCH (INTEGRAL TO PANIC DEVICE) SHUNTS DOOR CONTACTS FOR VALID EGRESS. FREE EGRESS AT ALL TIMES.

## HARDWARE GROUP NO. 04

FOR USE ON DOOR #(S): 101B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>
2	EA	CONT. HINGE	112XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9849-EO 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9849-NL-OP-110MD 24 VDC	626	VON
1	EA	RIM CYLINDER	C953-7CCA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
2	EA	90 DEG OFFSET PULL	8190HD 10" A	630	IVE
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	SURF. AUTO OPERATOR	4642 TBWMS 120 VAC	689	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T	630	LCN
1	EA	TOP RAIL DROP PLATE	SC70-18PA (AS REQ)	689	FAL
1	EA	CUSH SHOE SUPPORT	SC70-30 (AS REQ)	689	FAL
1	EA	BLADE STOP SPACER	SC70-61 (AS REQ)	689	FAL
1	EA	MULTITECH READER	MT15 [BY OWNER'S SECURITY CONTRACTOR]	BLK	SCE
1	EA	DESK MOUNT BUTTON	BY ACCESS CONTROL PROVIDER	628	SCE
2	EA	DOOR CONTACT	7764	628	SCE
1	EA	POWER SUPPLY	PS904 900-4RL [COORDINATE WITH ACCESS CONTROL PROVIDER]	LGR	SCE
1	EA	DIAGRAM	ELEVATION		DLR
1	EA	DIAGRAM	POINT TO POINT		DLR

OPERATION: DOORS NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL OR REMOTE PUSH BUTTON AT RECPETION DESK MOMENTARILY UNLOCKS DOOR ALLOWING ACCESS AND ACTIVATES EXTERIOR ACTUATOR. WHEN ACTIVE, PRESSING EXTERIOR ACTUATOR CYCLES AUTOMATIC OPERATOR AND MOMENTARILY OPENS DOOR. INTERIOR ACTUATOR ALWAYS ACTIVE. DOORS REMAIN CLOSED UPON LOSS OF POWER. DOOR CONTACTS TO MONITOR DOOR POSITION. RX SWITCH (INTEGRAL TO PANIC DEVICE) SHUNTS DOOR CONTACTS FOR VALID EGRESS. FREE EGRESS AT ALL TIMES.

DOORS CAN BE LEFT UNLOCKED AS PROGRAMMED BY ACCESS CONTROL.

## HARDWARE GROUP NO. 05

FOR USE ON DOOR #(S): 001A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>
6	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9850WDC-DT-LBL-SNB 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9850WDC-NL-LBL-SNB 24 VDC	626	VON
1	EA	RIM CYLINDER	C953-7CCA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
2	EA	SURFACE CLOSER	SC71A SSHO	689	FAL
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE
1	EA	MULTITECH READER	MT15 [BY OWNER'S SECURITY CONTRACTOR]	BLK	SCE
2	EA	DOOR CONTACT	679-05HM/679-05WD AS REQ'D	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-4RL [COORDINATE WITH ACCESS CONTROL PROVIDER]	LGR	SCE
1	EA	DIAGRAM	ELEVATION		DLR
1	EA	DIAGRAM	POINT TO POINT		DLR
OPERATION DOORS NORMALLY CLOSED AND LOCKED VALID CREDENTIAL MOMENTARILY					

UNLOCKS DOORALLOWING ACCESS. DOORS REMAIN CLOSED UPON LOSS OF POWER. DOOR CONTACTS TO MONITOR DOOR POSITION. RX SWITCH (INTEGRAL TO PANIC DEVICE) SHUNTS DOOR CONTACTS FOR VALID EGRESS. FREE EGRESS AT ALL TIMES.

DOORS CAN BE LEFT UNLOCKED AS PROGRAMMED BY ACCESS CONTROL.

#### HARDWARE GROUP NO. 06

FOR USE ON DOOR #(S): 133B

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<u>FINISH</u>	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
2	EA	DUMMY PUSH BAR	350-DT-990	626	VON
2	EA	SURFACE CLOSER	SC71A SS	689	FAL
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

# HARDWARE GROUP NO. 07

FOR USE ON DOOR #(S): 135A 135B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
2	EA	ELEC PANIC HARDWARE	LD-RX-9849-EO	626	VON
2	EA	SURFACE CLOSER	SC71A SS	689	FAL
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA	AA	ZER
2	EA	DOOR SWEEP	39A	А	ZER
1	EA	THRESHOLD	655A	А	ZER
2	EA	DOOR CONTACT	679-05HM/679-05WD AS REQ'D	BLK	SCE
1	EA	DIAGRAM	ELEVATION		DLR
1	EA	DIAGRAM	POINT TO POINT		DLR
OPERATION DOOD CONTACTS TO MONITOR DOOD POSITION BY SWITCH (INTEGRAL TO I					O PANIO

OPERATION:DOOR CONTACTS TO MONITOR DOOR POSITION. RX SWITCH (INTEGRAL TO PANIC DEVICE) SHUNTS DOOR CONTACTS FOR VALID EGRESS. FREE EGRESS AT ALL TIMES.

# HARDWARE GROUP NO. 08

FOR USE ON DOOR #(S): 129

<u>NISH MFR</u>
2 IVE
6 FAL
9 FAL
0 IVE
6 IVE
ZER

# HARDWARE GROUP NO. 09

FOR USE C	DN DOOR #(S):		
114	115	127	128

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

# HARDWARE GROUP NO. 10

FOR USE ON DOOR #(S):							
106	107	108	109	110	111		
112							

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	ENTRY / OFFICE LOCK	T511BDC QUA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

#### HARDWARE GROUP NO. 11

FOR USE ON DOOR #(S): 105 118

119A 130

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBBDC SPA [BY OWNER'S SECURITY CONTRACTOR]	626	SCE
1	EA	PERMANENT CORE	C607	626	FAL
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
<b>OPER</b>	ATION: N	ALID CREDENTIAL MOMENT	ARILY UNLOCKS DOOR ALLOWING A	CCESS.	FREE

EGRESS AT ALL TIMES.

# HARDWARE GROUP NO. 12

FOR USE ON DOOR #(S): 131A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBBDC SPA [BY OWNER'S SECURITY CONTRACTOR]	626	SCE
1	EA	PERMANENT CORE	C607	626	FAL
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
OPERATION: VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ACCESS. FREE					

EGRESS AT ALL TIMES.

# HARDWARE GROUP NO. 13

FOR USE O	N DOOR #(S):			
117	119B	119C	125A	138

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	CLASSROOM LOCK	T561BDC QUA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

# HARDWARE GROUP NO. 14

FOR USE ON DOOR #(S):

132

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	CLASSROOM LOCK	T561BDC QUA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

# HARDWARE GROUP NO. 15

FOR USE ON DOOR #(S): 125B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	SGL CYL X TURN DB	D141BDC	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	WS40	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

# HARDWARE GROUP NO. 16

FOR USE ON DOOR #(S): 002 004

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>	
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE	
1	EA	STOREROOM LOCK	T581BDC QUA	626	FAL	
1	EA	PERMANENT CORE	C607	626	FAL	
1	EA	ELECTRIC STRIKE	6211 FSE	630	VON	
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL	
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE	
1	EA	WALL STOP	WS401/402CVX	626	IVE	
3	EA	SILENCER	SR64	GRY	IVE	
1	EA	MULTITECH READER	MT15 [BY OWNER'S SECURITY CONTRACTOR]	BLK	SCE	
1	EA	POWER SUPPLY	BY ACCESS CONTROL PROVIDER			
1	EA	DIAGRAM	ELEVATION		DLR	
1	EA	DIAGRAM	POINT TO POINT		DLR	
OPER	OPERATION: VALID CREDENTIAL MOMENTARILY RETRACTS ELECTRIC STRIKE ALLOWING					
ACCES	ACCESS. FREE EGRESS AT ALL TIMES.					

# HARDWARE GROUP NO. 17

FOR USE ON DOOR #(S): 120A 120B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>	
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE	
1	EA	PANIC HARDWARE	98-L-NL-17	626	VON	
1	EA	RIM CYLINDER	C953-7CCA	626	FAL	
1	EA	PERMANENT CORE	C607	626	FAL	
1	EA	ELECTRIC STRIKE	6300 FSE	630	VON	
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL	
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE	
1	EA	WALL STOP	WS401/402CVX	626	IVE	
3	EA	SILENCER	SR64	GRY	IVE	
1	EA	MULTITECH READER	MT15 [BY OWNER'S SECURITY CONTRACTOR]	BLK	SCE	
1	EA	POWER SUPPLY	BY ACCESS CONTROL PROVIDER			
1	EA	DIAGRAM	ELEVATION		DLR	
1	EA	DIAGRAM	POINT TO POINT		DLR	
OPERA	OPERATION: VALID CREDENTIAL MOMENTARILY RETRACTS ELECTRIC STRIKE ALLOWING					
ACCES	ACCESS. FREE EGRESS AT ALL TIMES.					

## HARDWARE GROUP NO. 18

FOR USE ON DOOR #(S):

124

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	PANIC HARDWARE	98-L-NL-17	626	VON
1	EA	RIM CYLINDER	C953-7CCA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

# HARDWARE GROUP NO. 19

FOR USE ON DOOR #(S): 121

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	STOREROOM LOCK	T581BDC QUA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

#### HARDWARE GROUP NO. 20

FOR USE	ON DOOR #(S):			
126	136A	136B	137A	137B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>
6	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
2	EA	CONST LATCHING BOLT	FB51T/FB61T AS REQ	630	IVE
1	EA	CLASSROOM LOCK	T561BDC QUA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
2	EA	OH STOP	450S	689	GLY
2	EA	SILENCER	SR64	GRY	IVE

## HARDWARE GROUP NO. 21

FOR USE ON DOOR #(S):

120C 125A

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	CONST LATCHING BOLT	FB51T/FB61T AS REQ	630	IVE
1	EA	CLASSROOM LOCK	T561BDC QUA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
2	EA	WALL STOP	WS401/402CVX	626	IVE
2	EA	SILENCER	SR64	GRY	IVE

# HARDWARE GROUP NO. 22

FOR USE ON DOOR #(S): 123

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>
6	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	CONST LATCHING BOLT	FB51T/FB61T AS REQ	630	IVE
1	EA	STOREROOM LOCK	T581BDC QUA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
1	EA	COORDINATOR	COR X FL (MB AS REQ'D)	628	IVE
2	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS401/402CVX	626	IVE
2	EA	SILENCER	SR64	GRY	IVE
NOTE:	MOUNT	T CLOSERS TO SWING 180 DE	GREES.		

# HARDWARE GROUP NO. 23

FOR USE ON DOOR #(S):

134

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>
6	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	CONST LATCHING BOLT	FB51T/FB61T AS REQ	630	IVE
1	EA	STOREROOM LOCK	T581BDC QUA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
2	EA	WALL STOP	WS401/402CVX	626	IVE
2	EA	SILENCER	SR64	GRY	IVE
NOTE					

NOTE: MOUNT CLOSERS TO SWING 180 DEGREES.

## HARDWARE GROUP NO. 24

FOR USE ON DOOR #(S):

122

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	STOREROOM LOCK	T581BDC QUA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

# HARDWARE GROUP NO. 25

FOR USE ON DOOR #(S): 116

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	STOREROOM LOCK	T581BDC QUA	626	FAL
1	EA	PERMANENT CORE	C607	626	FAL
1	EA	SURFACE CLOSER	SC71A DEL RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

# HARDWARE GROUP NO. 26

FOR USE O	N DOOR #(S):	
125C	131B	135C

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		DESCRIPTION	CATALOG NUMBER	<b>FINISH</b>	<u>MFR</u>
1	EA	CYLINDER	MORTISE/RIM CYLINDER AS REQ'D	626	FAL
			BALANCE OF HARDWARE BY DOOR MFR		B/O

END OF SECTION

#### SECTION 08 80 00 - GLAZING

#### PART 1 - GENERAL

#### 1.1 **SUMMARY**

- Α. Section Includes:
  - 1. Glass products.
  - Laminated glass. 2.
  - 3. Insulating glass.
  - 4. Glazing sealants.
  - 5. Miscellaneous glazing materials.

#### 1.2 COORDINATION

Α. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

#### 1.3 ACTION SUBMITTALS

- Product Data: For each type of product. Α.
- Β. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
  - Samples not required if Basis of Design is provided in project. 1.

#### 1.4 WARRANTY

- Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace Α. insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
  - Warranty Period: 10 years from date of Substantial Completion. 1.

#### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

Safety Glazing: Where safety glazing is indicated, provide glazing that complies with Α. 16 CFR 1201, Category II.

GLAZING

project.(13619)

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### 2.2 GLASS PRODUCTS, GENERAL

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

### 2.3 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
  - 1. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide <u>Vitro</u> <u>Architectural Glass</u>; or comparable product by one of the following:
    - a. Guardian Glass; SunGuard.
    - b. Pilkington North America.
- B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.
- C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- E. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

### 2.4 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
  - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
  - 2. Perimeter Spacer: Clear Annodized Alum. .
  - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

## 2.5 GLAZING SEALANTS

- A. General:
  - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.
  - 1. <u>Manufacturers</u>: 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. GE Construction Sealants; Momentive Performance Materials Inc.
    - b. Pecora Corporation.
    - c. Sika Corporation.
    - d. The Dow Chemical Company.
    - e. Tremco Incorporated.

### 2.6 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- B. Setting Blocks:
  - 1. EPDM with Shore A durometer hardness of 85, plus or minus 5.
  - 2. Type recommended in writing by sealant or glass manufacturer.
- C. Edge Blocks:
  - 1. EPDM with Shore A durometer hardness per manufacturer's written instructions.
  - 2. Type recommended in writing by sealant or glass manufacturer.

#### PART 3 - EXECUTION

#### 3.1 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

### 3.2 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.

### 3.3 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry

surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

- 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- 3.4 MONOLITHIC GLASS SCHEDULE
  - A. Ultraclear Glass Type : Fully temperedfloat glass MG-1.
    - 1. Basis-of-Design Product: Vitro Clear .
    - 2. Minimum Thickness: 6 mm .
    - 3. Safety glazing required.

## 3.5 LAMINATED GLASS SCHEDULE

- A. Clear Laminated Glass Type MG-2 : Two plies of heat-strengthened float glass.
  - 1. Basis-of-Design Product: Vitro Clear .
  - 2. Minimum Thickness of Each Glass Ply: 6 mm .
  - 3. Interlayer Thickness: 0.060 inch .
  - 4. Safety glazing required.
- 3.6 INSULATING GLASS SCHEDULE
  - A. Low-E-Coated, Tinted Insulating Glass Type IG-1 :
    - 1. Basis-of-Design Product: Vitro Architectural Glass .
    - 2. Overall Unit Thickness: 1 inch .
    - 3. Minimum Thickness of Each Glass Lite: 6 mm .
    - 4. Outdoor Lite: Tinted fully tempered float glass.a. Tint Color: Solarblue 6mm.
    - 5. Interspace Content: Air .
    - 6. Indoor Lite: Clear fully tempered float glass.
      - a. Clear Float 6mm
    - 7. Low-E Coating: 3rd surface.
      - a. Solarban 60
    - 8. Safety glazing required.

# END OF SECTION 08 80 00

## SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

### PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Non-load-bearing steel framing systems for interior partitions.
- B. Related Requirements:
  - 1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

## 1.2 ACTION SUBMITTALS

- A. Product data and schedule for studs in walls demonstrating compliance with structural performance indicated in the drawings and specifications.
  - 1. Indicate compliance with deflection criteria at walls receiving ceramic tile finishes.

### 1.3 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.
- 1.4 DELIVERY, STORAGE, AND HANDLING
  - A. Notify manufacturer of damaged materials received prior to installation.
  - B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
  - C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

### PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
  - A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate nonload-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Horizontal Deflection: For composite wall assemblies, limited to 1/240 of the wall height measured from bottom track to top track based on horizontal loading of 5 lbf/sq. ft. .
  - 1. Horizontal Deflection for wall assemblies receiving ceramic tile finish limited to 1/360 of the wall height measured from the bottom track to the top track based on a horizontal loading of 5 lbf/sq.ft.
- D. Horizontal Deflection: For non-composite wall assemblies, limited to 1/240 of the wall height measured from bottom track to top track based on horizontal loading of 5 lbf/sq. ft.
  - 1. Horizontal Deflection for wall assemblies receiving ceramic tile finish limited to 1/360 of the wall height measured from the bottom track to the top track based on a horizontal loading of 5 lbf/sq.ft.
- E. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing Nonstructural Members," unless otherwise indicated.
- F. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.
- G. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 1 inch .

## 2.2 FRAMING SYSTEMS

- A. Studs and Track: ASTM C645 .
  - 1. <u>Manufacturers</u>: 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. ClarkDietrich.
    - b. Marino\WARE.
    - c. Telling Industries.
  - 2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection .
  - 3. Depth: As indicated on Drawings .
- B. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. <u>Manufacturers</u>: 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. ClarkDietrich.
    - b. Marino\WARE.
  - 2. Minimum Base-Steel Thickness: 0.0329 inch .

- C. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.
  - 1. <u>Manufacturers</u>: 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. ClarkDietrich.
    - b. Marino\WARE.
  - 2. Depth: 1-1/2 inches .
  - 3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- D. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
  - 1. <u>Manufacturers</u>: 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. ClarkDietrich.
    - b. Marino\WARE.
  - 2. Configuration: Asymmetrical .

## PART 3 - EXECUTION

## 3.1 EXAMINATION

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

## 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

## 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- 3.4 INSTALLING FRAMED ASSEMBLIES
  - A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
    - 1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
    - 2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
    - 3. Tile Backing Panels: As required by horizontal deflection performance requirements unless otherwise indicated.
  - B. Install studs so flanges within framing system point in same direction.
    - 1. Install studs with fasteners at both legs unless noted otherwise.
    - 2. Where double studs ore indicated indicated such as at door jambs, mechanically fasten double studs together prior as indicated on the drawings.
  - C. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
    - 1. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
      - a. Install two studs at each jamb unless otherwise indicated.
        - 1) Tie studs together as indicated on the drawings.
      - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - 2. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
    - 3. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
  - Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Interior gypsum board.
    - 2. Tile backing panels.

## B. Submittals:

- 1. Product Data for each product indicated.
- PART 2 PRODUCTS
- 2.1 PERFORMANCE REQUIREMENTS
  - A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- 2.2 GYPSUM BOARD, GENERAL
  - A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- 2.3 INTERIOR GYPSUM BOARD
  - A. Gypsum Board, Type X: ASTM C1396/C1396M.
    - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
      - a. American Gypsum.
      - b. CertainTeed Gypsum.
      - c. Georgia-Pacific Gypsum LLC.
      - d. National Gypsum Company.
      - e. USG Corporation.
    - 2. Thickness: 5/8 inch.
    - 3. Long Edges: Tapered .
- 2.4 TILE BACKING PANELS
  - A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.
    - 1. <u>Products:</u> Subject to compliance with requirements, provide one of the following:
      - a. CertainTeed Corporation; GlasRoc Tile Backer
      - b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer
      - c. USG Corporation; USG Durock<sup>™</sup> Glass-Mat Tile Backerboard.

GYPSUM BOARD

- 2. Core: 5/8 inch , Type X.
- 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

### 2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
  - 1. Material: Paper-faced galvanized-steel sheet.
  - 2. Shapes:
    - a. Cornerbead.
    - b. Expansion (control) joint.

## 2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
  - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints , rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
  - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound .
- D. Joint Compound for Tile Backing Panels:
  - 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

### 2.7 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
  - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

- 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."
- E. Acoustical Sealant for concealed Joints: Manufacturer'sstandard nonsag, paintable, nonstaining latex acoustical sealant complying withASTM C834.
  - 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. GE Construction Sealants; Momentive Performance Materials Inc.
    - b. Hilti, Inc.
    - c. Specified Technologies, Inc.
    - d. Tremco Incorporated.
    - e. USG Corporation

## PART 3 - EXECUTION

- 3.1 INSTALLATION AND FINISHING OF PANELS
  - A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
  - B. Comply with ASTM C840.
  - C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
  - D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
  - E. Prefill open joints , rounded or beveled edges, and damaged surface areas.
  - F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
  - G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
    - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
    - 2. Level 2: Panels that are substrate for tile .
    - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated .
      - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
    - 4. Level 5: Where indicated on Drawings .
      - a. Provide Level 5 finish at locations indicated on the drawings to receive Dry-Erase Marker Coatings.
      - b. Primer and its application to surfaces are specified in Section 099100 "Painting."

#### **GYPSUM BOARD**

H. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

## 3.2 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 29 00

#### SECTION 09 30 13 - CERAMIC TILING

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Glazed wall tile.
    - 2. Metal edge strips.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples:
  - 1. Each type and composition of tile and for each color and finish required.
- C. Shop Drawings: For tile installation, plans showing the following:
  - 1. Tile type, size, and color.
  - 2. Pattern type, locations, and direction.
  - 3. Type, color, and location of edge, transition, and other accessory strips.
  - 4. Transition detail from floor to wall.

#### PART 2 - PRODUCTS

#### 2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

### 2.2 TILE PRODUCTS

- A. Ceramic Tile Type: Ceramic White Body Wall Tile (CT1, CT2, CT3)
  - 1. Floor Tile: Provide products as indicated in Interior Finish Legend on Drawings.
  - 2. Grout Color: Colors as indicated in Interior Finish Legend on Drawings.

#### 2.3 SETTING MATERIALS

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide TEC, Ultimate Mortar or comparable product by one of the following:
    - a. H.B. Fuller Construction Products Inc. / TEC.
    - b. MAPEI Corporation

- c. Laticrete International, Inc
- 2. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
- 3. For floor and wall tile applications, provide nonsagging mortar.

### 2.4 GROUT MATERIALS

- A. High-Performance Polymer-Modified Tile Grout: ANSI A118.7 and ANSI A118.3.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide TEC Power Grout, or comparable product by one of the following:
    - a. H.B. Fuller Construction Products Inc. / TEC.
    - b. MAPEI Corporation
    - c. Laticrete International, Inc
  - 2. For use at ceramic wall tile applications.

### 2.5 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."
  - 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Use primers, backer rods and sealant accessories recommended by sealant manufacturer.
  - 3. Provide TEC, Accucolor 100, 100% Silicone Sealant or equal.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated
- C. Refer to TCNA Handbook, Method EJ171A-G-11 for recommendations on locating and detailing various types of construction joints
- D. Provide soft joint to match grout joint color at all locations where a change in plane occurs.

### 2.6 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
  - 1. Provide surface preparation as required to achieve surface tolerance for each tile type indicated per ANSI A108.02 and all TCNA requirements.
  - 2. Provide product from same manufacturer as installation materials.
- B. Metal Edge Strips: Provide the following, heights to match tile and setting-bed thickness, or a comparable product by another manufacturer:
  - 1. Ceramic wall tile outside edges: Schluter-Schiene, Satin Anodized Aluminum (AE)
  - 2. Ceramic wall tile to finished floor: Schluter-Dilex-AHKH, Satin Anodized Aluminum (AE)

- C. Grout Release: Provide grout test or mock-up for approval to determine if grout release will be required.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

### PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.3 INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    - a. Tile floors in wet areas.

- b. Tile floors consisting of tiles 8 by 8 inches or larger.
- c. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
  1. Glazed Wall Tile: 1/8 inch .
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Metal Edge Strips: Install at locations indicated .
- J. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

### 3.4 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

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#### 3.5 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Wall Installations, Wood or Metal Studs or Furring:
  - 1. Ceramic Tile Installation : TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.
    - a. Ceramic Tile Type: Porcelain tile and ceramic tile .
    - b. Thinset Mortar: Modified dry-set mortar.
    - c. Grout: High-performance sanded grout.

## END OF SECTION 09 30 13

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## SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
- 1.2 PREINSTALLATION MEETINGS
  - A. Preinstallation Conference: Conduct conference at Project site .
- 1.3 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Samples: For each exposed product and for each color and texture specified.
- 1.4 INFORMATIONAL SUBMITTALS
  - A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Maintenance data.
- PART 2 PRODUCTS
- 2.1 PERFORMANCE REQUIREMENTS
  - A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - 1. Flame-Spread Index: Class A according to ASTM E 1264.
    - 2. Smoke-Developed Index: 50 or less.
- 2.2 ACOUSTICAL PANELS APC1, APC2
  - A. Basis-of-Design Products: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
  - B. Acoustical Panel Standard: Manufacturer's standard panels according to ASTM E 1264.
  - C. Classification: As indicated by manufacturer's designations .
  - D. Color: As indicated on Drawings.
  - E. Ceiling Attenuation Class (CAC): As indicated on Drawings .

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- F. Noise Reduction Coefficient (NRC): As indicated on Drawings .
- G. Articulation Class (AC): As indicated on Drawings .
- H. Edge/Joint Detail: As indicated by manufacturer's designation .
- I. Thickness: As indicated on Drawings .
- J. Modular Size: As indicated on Drawings .
- 2.3 METAL SUSPENSION SYSTEM
  - A. Basis-of-Design Products: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
  - B. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M.
  - C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
    - 1. Structural Classification: Intermediate -duty system.
    - 2. End Condition of Cross Runners: Override (stepped) type.
    - 3. Face Design: Flat, flush.
    - 4. Cap Material: Cold-rolled steel .
    - 5. Cap Finish: Painted white .
- 2.4 ACCESSORIES
  - A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.
- B. Layout openings for penetrations centered on the penetrating items.
- 3.2 INSTALLATION
  - A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

- Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and Β. where necessary to conceal edges of acoustical panels.
  - Do not use exposed fasteners, including pop rivets, on moldings and trim. 1.

END OF SECTION 09 51 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Thermoplastic-rubber base.
    - 2. Rubber stair accessories.
    - 3. Vinyl stair accessories.
    - 4. Vinyl molding accessories.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Samples: For each exposed product and for each color and texture specified.
- PART 2 PRODUCTS
- 2.1 THERMOPLASTIC-RUBBER BASE RB1
  - A. Basis-of-Design Product: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
  - B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
    - 1. Group: I (solid, homogeneous).
    - 2. Style and Location:
      - a. Style B, Cove .
  - C. Thickness: 0.125 inch .
  - D. Height: As indicated on Drawings.
  - E. Lengths: Coils in manufacturer's standard length .
  - F. Outside Corners: Job formed .
  - G. Inside Corners: Job formed .
  - H. Colors: As indicated on Drawingss .
- 2.2 RUBBER STAIR ACCESSORIES RSA1, RSA2
  - A. Basis-of-Design Product: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
  - B. Stair Treads: ASTM F 2169.

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- 1. Type: TP (rubber, thermoplastic).
- 2. Class: 2 (pattern; embossed, grooved, or ribbed).
- 3. Group: 2 (with contrasting color for the visually impaired).
- 4. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees .
- 5. Nosing Height: 2 inches .
- 6. Thickness: 1/4 inch and tapered to back edge .
- 7. Size: Lengths and depths to fit each stair tread in one piece .
- C. Separate Risers: Smooth, flat; in height that fully covers substrate; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
  - 1. Style: Coved toe, 7 inches high by length matching treads .
  - 2. Thickness: Manufacturer's standard .
- D. Locations: Provide rubber stair accessories in areas indicated .
- E. Colors and Patterns: As indicated on Drawings .
- 2.3 VINYL STAIR ACCESSORIES RSA3
  - A. Stair Nosing: ASTM F 2169, Type TV (vinyl, thermoplastic).
    - 1. Class: 1 (smooth, flat).
    - 2. Group: 2 (with contrasting color for the visually impaired).
    - 3. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees .
    - 4. Nosing Height: 2 inches .
    - 5. Thickness: 1/4 inch and tapered to back edge .
    - 6. Size: Lengths and depths to fit each stair tread in one piece .
  - B. Colors and Patterns: As indicated by manufacturer's designations .
- 2.4 VINYL MOLDING ACCESSORY RTS1
  - A. Description: Vinyl reducer strip .
  - B. Profile and Dimensions: As indicated on drawings.
  - C. Locations: Provide vinyl molding accessories in areas indicated .
  - D. Colors and Patterns: As indicated on Drawings .
- 2.5 INSTALLATION MATERIALS
  - A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

#### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
  - 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 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 F 1869. Proceed with installation only after substrates have 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 F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until materials are the same temperature as space where they are to be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

- E. Do not stretch resilient base during installation.
- F. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Miter or cope corners to minimize open joints.

### 3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
  - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
  - 2. Tightly adhere to substrates throughout length of each piece.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.
- 3.4 CLEANING AND PROTECTION
  - A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
  - B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:1. Luxury Vinyl Planks
- 1.2 ACTION SUBMITTALS
  - A. Samples: For each exposed product and for each color and pattern specified.
  - B. Testing Documentation: Provide required sub-floor testing results prior to installation.
- 1.3 CLOSEOUT SUBMITTALS
  - A. Maintenance data for owner.
- 1.4 PROJECT CONDITIONS
  - A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
  - B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
  - C. Install resilient products after other finishing operations, including painting, have been completed..

PART 2 - PRODUCTS

- 2.1 LUXURY VINYL PLANKS RFT1
  - A. Basis-of-Design Product: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
  - B. Tile Standard: ASTM F 1700.
    - 1. Class: Class III, Printed Film Vinyl Tile.
    - 2. Type: B, Embossed Surface.
  - C. Thickness: 0.120 inch .
  - D. Size: As indicated on Drawings .
  - E. Colors and Patterns: As indicated on Drawings .

## 2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
  - 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 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 F 1869. Proceed with installation only after substrates have 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 F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

## 3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis in pattern indicated on Drawings.

- C. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- D. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- F. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

END OF SECTION 09 65 19

SECTION 09 68 13 - TILE CARPETING

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Modular carpet tile.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Shop Drawings: For carpet tile installation, plans showing the following:
    - 1. Carpet tile type, color, and dye lot.
    - 2. Type of installation.
    - 3. Pattern of installation.
    - 4. Pattern type, location, and direction.
    - 5. Type, color, and location of edge, transition, and other accessory strips.
    - 6. Transition details to other flooring materials.
  - C. Samples: For each exposed product and for each color and texture required.
- 1.3 CLOSEOUT SUBMITTALS
  - A. Maintenance data.
- PART 2 PRODUCTS
- 2.1 CARPET TILE CPT1, CPT2
  - A. Products: Subject to compliance with requirements, provide the following:
    - 1. Manufacturers: As indicated in the Drawings.
      - a. Patterns, Colors, Sizes, and Backings: As indicated in the Drawings.
      - b. Installation patterns: As indicated in the Drawings.
  - B. Primary Backing/Backcoating: Manufacturer's standard composite materials .
  - C. Applied Treatments:
    - 1. Soil-Resistance Treatment: Manufacturer's standard treatment .

## 2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
- PART 3 EXECUTION
- 3.1 EXAMINATION
  - A. Concrete Slabs:
    - 1. Moisture Testing: Perform tests so that each test area does not exceed 1000 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 have 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 75 percent relative humidity level measurement.
      - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

### 3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

#### 3.3 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings .
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.
- I. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 72 00 - WALL COVERINGS

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:1. Vinyl wall covering.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified.
- 1.3 CLOSEOUT SUBMITTALS
  - A. Maintenance data.
- PART 2 PRODUCTS
- 2.1 PERFORMANCE REQUIREMENTS
  - A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - 1. Fire-Growth Contribution: No flashover and heat and smoke release when tested in accordance with NFPA 265 NFPA 286.
- 2.2 VINYL WALL COVERING WC1, WC2, WC3
  - A. Basis-of-Design Product: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
  - B. Description: Provide vinyl products in rolls from same production run and complying with the following:
    - 1. FS CCC-W-408D and Wallcovering Association's W-101 for Type II, Medium Duty.
  - C. Total Weight: 20 oz. per lineal yd , excluding coatings.
  - D. Backing: Osnaburg fabric.
  - E. Mildew Resistance: Rating of zero or 1 when tested in accordance with ASTM G21.
  - F. Features:

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- 1. Water-based inks.
- 2. Phthalate free.
- 3. Heavy-metals free.
- 4. Halogenated-fire-retardant free.
- G. Colors, Textures, and Patterns: As indicated on drawings. Custom Digital Images, to be provided by architect .
- 2.3 ACCESSORIES
  - A. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.
  - B. Primer/Sealer: Mildew resistant, complying with requirements in Section 09 91 23 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
  - 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
  - 2. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
- D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

### 3.2 INSTALLATION OF WALL COVERING

- A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.
- B. Install wall covering without lifted or curling edges and without visible shrinkage.
- C. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

- D. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
- E. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.
- F. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 00

#### SECTION 09 91 00 - PAINTING

#### PART 1 - GENERAL

- 1.1 SECTION INCLUDES
  - A. Interior paint and coatings systems including surface preparation.
  - B. Exterior paint and coatings systems including surface preparation.

#### 1.2 REFERENCES

- A. Steel Structures Painting Council (SSPC):
  - 1. SSPC-SP 1 Solvent Cleaning.
  - 2. SSPC-SP 2 Hand Tool Cleaning.
  - 3. SSPC-SP 3 Power Tool Cleaning.
  - 4. SSPC-SP5/NACE No. 1, White Metal Blast Cleaning.
  - 5. SSPC-SP6/NACE No. 3, Commercial Blast Cleaning.
  - 6. SSPC-SP7/NACE No. 4, Brush-Off Blast Cleaning.
  - 7. SSPC-SP10/NACE No. 2, Near-White Blast Cleaning.
  - 8. SSPC-SP11, Power Tool Cleaning to Bare Metal.
  - 9. SSPC-SP12/NACE No. 5, Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating.
  - 10. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete.
- B. Material Safety Data Sheets / Environmental Data Sheets: Per manufacturer's MSDS/EDS for specific VOCs (calculated per 40 CFR 59.406). VOCs may vary by base and sheen.

#### 1.3 SUBMITTALS

- A. Product Data: For each paint system indicated, including.
  - 1. Product characteristics.
  - 2. Surface preparation instructions and recommendations.
  - 3. Primer requirements and finish specification.
  - 4. Storage and handling requirements and recommendations.
  - 5. Application methods.
  - 6. Cautions for storage, handling and installation.
- B. Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's products, colors and sheens available.
- C. Verification Samples: For each finish product specified, submit samples that represent actual product, color, and sheen.
- D. Only submit complying products based on project requirements. One must also comply with the regulations regarding VOCs (CARB, OTC, SCAQMD, LADCO). To ensure compliance with

district regulations and other rules, businesses that perform coating activities should contact the local district in each area where the coating will be used.

### 1.4 QUALITY ASSURANCE

- A. Paint exposed surfaces. If a color of finish, or a surface is not specifically mentioned, General Contractor will select from standard products, colors and sheens available.
- B. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels unless indicated.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information.
  - 1. Product name, and type (description).
  - 2. Application and use instructions.
  - 3. Surface preparation.
  - 4. VOC content.
  - 5. Environmental handling.
  - 6. Batch date.
  - 7. Color number.
- B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- C. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.
- D. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

### 1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

### 1.7 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
- B. Furnish Owner with an additional one percent of each material and color, but not less than 1 gal (3.8 l) or 1 case, as appropriate.

#### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Sherwin-Williams, which is located at: 101 Prospect Ave.; Cleveland, OH 44115; Toll Free Tel: 800-524-5979; Tel: 216-566-2000; Fax: 440-826-1989; Email: request infospecifications@sherwin.com; Web:www.swspecs.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 Product Requirements.

#### 2.2 APPLICATIONS/SCOPE

- A. Interior Paints and Coatings:
  - 1. Gypsum Board.
  - 2. Metal: Aluminum, galvanized steel.
  - 3. Wood: Trim.
  - 4. Concrete: Concrete floors (non-vehicular).
- B. Exterior Paints and Coatings:
  - 1. Metal: Aluminum, galvanized steel.
  - 2. Metal: Miscellaneous iron, ornamental iron, ferrous metal.

### 2.3 PAINT MATERIALS - GENERAL

- A. Paints and Coatings:
  - 1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
  - 2. For opaque finishes, tint each coat including primer coat and intermediate coats, onehalf shade lighter than succeeding coat, with final finish coat as base color. Or follow manufactures product instructions for optimal color conformance.
- B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.
- D. Color: Refer to Finish Schedule for paint colors, and as selected.
- 2.4 INTERIOR PAINT SYSTEMS (LEED-V4 NC/CI/CS COMPLIANT)
  - A. METAL: Aluminum, Galvanized.
    - 1. Latex Systems:
      - a. Eg-Shel / Satin Finish High Performance:
- 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
- 2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils (0.064 to 0.102 mm) dry, per coat.
- 3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils (0.064 to 0.102 mm) dry, per coat.
- B. METAL: Galvanized; Ceilings, Duct work.
  - 1. Dryfall Waterborne Topcoats:
    - a. Flat Finish:
      - 1) 1st Coat: S-W Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series.
      - 2) 2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series (6.0 mils wet, 1.7 mils dry per coat).
- C. METAL (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous and Ornamental Iron, Structural Iron, Ferrous Metal)
  - 1. Dryfall Waterborne Topcoat:
    - a. Flat Finish:
      - 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
      - 2) 2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series.
      - 3) 3rd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series (6.0 mils wet, 1.7 mils dry per coat).
- D. WOOD (Walls, Ceilings, Doors, Trim):
  - 1. Latex Systems:
    - a. Eg-Shel / Satin Finish:
      - 1) 1st Coat: S-W Premium Wall and Wood Primer, B28W8111 (4 mils wet, 1.8 mils dry).
      - 2) 2nd Coat: S-W ProClassic Waterborne Acrylic Satin, B20 Series.
      - 3) 3rd Coat: S-W ProClassic Waterborne Acrylic Satin, B20 Series (4 mils wet, 1.2 mils dry per coat).
  - 2. Stain and Varnish System:
    - a. Satin Finish:
      - 1) 1st Coat: SW Minwax Performance Series Tintable Wood Stain 250 VOC.
      - 2) 2nd Coat: S-W Minwax Waterbased Oil-Modified Polyurethane.
      - 3) 3rd Coat: S-W Minwax Waterbased Oil-Modified Polyurethane (4 mils wet, 1.0 mil dry per coat).
- E. DRYWALL (Walls, Ceilings, Gypsum Board and similar items)
  - 1. Latex Systems:
    - a. Eg-Shel / Satin Finish:
      - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (4 mils wet, 1.5 mils dry).
      - 2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series.
      - 3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series (4 mils wet, 1.7 mils dry per coat).

- F. CONCRETE (Floors)
  - 1. Water-Based System:
    - a. Low Luster Finish:
      - 1) 1st Coat: Sherwin Williams, H&C Colortop Water-Based Solid Color Concrete Stain
      - 2) 2nd Coat: Sherwin Williams, H&C Colortop Water-Based Solid Color Concrete Stain

# 2.5 EXTERIOR PAINT SYSTEMS

- A. METAL: Misc. Iron, Ornamental Iron, Structural Iron and Steel, Ferrous Metal.
  - 1. Latex Systems:
    - a. Semi-Gloss Finish:
      - 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0-10.0 mils wet, 1.8-3.6 mils dry).
      - 2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss, B66-650.
      - 3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss, B66-650 (2.0-4.0 mils dry per coat).

# PART 3 - EXECUTION

- 3.1 EXAMINATION
  - A. Do not begin installation until substrates have been properly prepared; notify General Contractor of unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify General Contractor of unsatisfactory preparation before proceeding.
  - B. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

#### 3.2 SURFACE PREPARATION

- A. General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.
  - 1. Prior to attempting to remove mildew, it is recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions are advised.
  - 2. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply solution and scrub the mildewed area. Allow solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow surface to dry before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.
  - 3. Remove items including but not limited to thermostats, electrical outlets, switch covers and similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

- 4. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50 degrees F (10 degrees C), unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface and material temperatures must be 50 degrees F (10 degrees F) or higher to use low temperature products.
- B. Aluminum: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.
- C. Drywall Interior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.
- D. Galvanized Metal: Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP16 is necessary to remove these treatments.
- E. Steel: Structural, Plate, And Similar Items: Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.
  - 1. Solvent Cleaning, SSPC-SP1: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
  - 2. Hand Tool Cleaning, SSPC-SP2: Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
  - 3. Power Tool Cleaning, SSPC-SP3: Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
  - 4. White Metal Blast Cleaning, SSPC-SP5 or NACE 1: A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
  - 5. Commercial Blast Cleaning, SSPC-SP6 or NACE 3: A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before

blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

- 6. Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4: A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.
- 7. Power Tool Cleaning to Bare Metal, SSPC-SP11: Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.
- 8. Near-White Blast Cleaning, SSPC-SP10 or NACE 2: A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
- 9. High- and Ultra-High Pressure Water Jetting for Steel and Other Hard Materials: SSPC-SP12 or NACE 5: This standard provides requirements for the use of high- and ultra-high pressure water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only without the addition of solid particles in the stream.
- 10. Water Blasting, SSPC-SP12/NACE No. 5: Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.
- F. Wood: Must be clean and dry. Prime and paint as soon as possible. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.

# 3.3 INSTALLATION

- A. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendations.
- B. Do not apply to wet or damp surfaces. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days. Test new concrete for moisture content. Wait until wood is fully dry after rain or morning fog or dew.
- C. Apply coatings using methods recommended by manufacturer.

- D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.
- E. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.
- F. Regardless of number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.
- G. Inspection: The coated surface must be inspected and approved by the General Contractor just prior to the application of each coat.

# 3.4 PROTECTION

- A. Protect finished coatings from damage until completion of project.
- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION 09 91 00

#### SECTION 09 97 35 - DRY ERASE COATINGS

- PART 1 GENERAL
- 1.1 RELATED DOCUMENTS
- 1.2 SUMMARY
  - A. Systems for field applied dry erase coatings.

#### 1.3 REFERENCES

- A. ASTM D 16: Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. Painting & Decorating Contractors of America (PDCA) Standards: P1 to P24.
- C. Gypsum Association (GA): GA 214, Recommended Levels of Gypsum Board Finish.

#### 1.4 DEFINITIONS

- A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.
- B. DFT: Dry film thickness.
- 1.5 ACTION SUBMITTALS
  - A. Product Data: Submit manufacturer's product information for each coating, including generic description, complete technical data, storage and handling requirements and application instructions.
  - B. Color Samples: Prepare color and finishes samples, 8-1/2 inches x 11 inches in size. Samples shall be resubmitted as requested until required sheen, color, and texture is achieved. Label and identify each sample as to location and application.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
- 1.7 CLOSEOUT SUBMITTALS
  - A. Maintenance Instructions: Provide manufacturer's recommended maintenance and cleaning instructions for the coated surfaces.
    - 1. Warranty: 3 signed copies.
- 1.8 QUALITY ASSURANCE
  - A. Manufacturer's Qualifications:

- B. Manufacturer of high performance coatings with a demonstrated minimum of 10 years of successful experience.
- C. Manufacturer shall supply a list of successfully completed projects of a comparable type.
- D. Source Responsibility: Coatings shall be products of a single supplier.
- E. Applicator's Qualifications:
  - 1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this Work.
  - 2. Applicator's Personnel: Supervisory personnel shall be trained/experienced in the successful application of the specified coatings.
- F. Comply with applicable codes and regulations of government agencies having jurisdiction over airborne emissions, rinse runoff and industrial waste disposal. Where those requirements conflict with this specification, comply with the more stringent provisions.
- G. Comply with current applicable regulations of the state and local air pollution control agencies/districts and the Environmental Protection Agency (EPA).
- 1.9 Mock-ups:
  - A. Before proceeding with the work, apply a sample area of approximately 100 sq ft, including primer, to an area as directed by the Architect.
  - B. Prepare mock-ups for Architect's review and to establish requirements for substrate finish and final coating application, texture, sheen and color.
  - C. Correct areas, modify method of application and installation, or adjust finish texture as directed by the Architect to comply with the specified requirements.
  - D. Maintain mock-up accessible to serve as a standard of quality for this Section.
  - E. Accepted mock-up may remain in place.
- 1.10 DELIVERY, STORAGE, AND HANDLING
  - A. Delivery: Deliver materials to job site in manufacturer's original, unopened containers and packaging, with all labeling clearly identifying:
  - B. Coating or material name.
  - C. Manufacturer.
  - D. Color name and number.
  - E. Batch or lot number.

- F. Date of manufacture.
- G. Mixing and thinning instructions.
- 1.11 Storage:
  - A. Store materials in a clean, dry area and within temperature range in accordance with manufacturer's instructions.
  - B. Keep containers sealed until ready for use.
  - C. Do not use materials beyond manufacturer's shelf life limitations.
  - D. Handling: Protect materials during handling and application to prevent damage or contamination.

#### 1.12 PROJECT CONDITIONS

- A. Weather:
  - 1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
  - 2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
  - 3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
- 1.13 Dust and Contaminants:
  - A. Schedule coating work to avoid excessive dust and airborne contaminants.
  - B. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

#### 1.14 WARRANTY

- A. Failures include, but are not limited to, the following:
  - 1. Water penetration through the coating.
  - 2. Deterioration of coating beyond normal weathering.
- B. Warranty Period: Ten (10) years from date of Substantial Completion.
  - 1. The manufacturer's warranty is be fully paid for by the coating applicator. The Warranty is to cover both labor and materials, without financial limits, required to remove defective materials and recoat areas in which moisture has penetrated structurally sound materials.
  - 2. Provide warranty signed by the Contractor, coating applicator and manufacturer.
  - 3. This warranty is in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.

## PART 2 - PRODUCTS

- 2.1 Products: Subject to compliance with requirements, provide one of the following:
  - A. MDC FUZETM Dry Erase Coating, MDC, 400 High Grove Blvd, Glendale Heights, Illinois (847) 473-4000.
  - B. Or other as approved by Architect.
- 2.2 Dry erase coating performance requirements:
  - A. Color: Clear
  - B. VOC (EPA Method 24)1. White 89 g/L Part A&B mixed.
  - C. Solids: 1. White 92 percent.
  - D. Gloss: ASTM D 523.1. White 90+ at 60 degrees.
  - E. Fire Rating: ASTM E 84, Class A.
- 2.3 Recommended acrylic primers:
  - A. Glidden Gripper Primer.
  - B. Kilz Premium Primer.
  - C. Sherwin-Williams Multi-Purpose Latex Primer/Sealer.

## 2.4 INTERIOR COATING SYSTEMS

- A. Gypsum Board:
  - 1. System Type: Acrylic primer / modified epoxy dry erase topcoat.
  - 2. Surface Preparation: Remove hardware, accessories, plates and similar items to allow dry erase coatings to be installed.
  - 3. Primer.
  - 4. Finish Coat: MDC FUZETM.
  - 5. Sheen: Gloss
  - 6. Total DFT: 4.0 to 8.0 mils.
- 2.5 ACCESSORIES
  - A. Use accessories required for application of specified coatings in accordance with manufacturer's recommendations, including thinners.

B. Roller: Purdy White Dove 1/4 inch nap roller as included in kit by manufacturer. No substitutions permitted.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas and conditions under which dry erase coating system is to be applied. Notify Architect of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.
- B. Wall surfaces to receive dry erase coating shall be dry and free from dirt, grease, loose paint and scale.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.

# 3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

#### 3.3 SURFACE PREPARATION

- A. Gypsum Board:
  - 1. Prepare gypsum board surfaces in accordance with Level 5 Drywall Finish.
  - 2. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
  - 3. Sand joint compound smooth and feather the edge to match.
  - 4. Avoid heavy sanding of adjacent gypsum board surfaces, which will raise nap of paper covering.
  - 5. Do not apply putty, patching pencils, caulking, or masking tape to gypsum board surfaces to be painted.
  - 6. Lightly scuff sand tape joints after priming to remove raised paper nap. Do not sand through primer
- B. Medium-Density Fiberboard (MDF):
  - 1. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
  - 2. Scuff sand the substrate with 150 to 220 grit sandpaper to achieve a slight etch.
- C. Previously Coated Surfaces:
  - 1. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminates.
  - 2. Scuff sand the substrate with 150 to 220 grit sandpaper to achieve a slight etch.

3. Before applying dry erase coating, a test or mock-up shall be performed to ensure adhesion, appearance and color are compatible with the existing substrate coating.

## 3.4 APPLICATION

- A. Apply coatings in accordance with manufacturer's instructions.
- B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
- C. Keep containers closed when not in use to avoid contamination.
- D. Do not use mixed coatings beyond pot life limits.
- E. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.
- F. Uniformly apply coatings at spreading rate required to achieve specified DFT.
- G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.
- 3.5 REPAIR
  - A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.
  - B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.
  - C. Coating Defects: Repair, in accordance with manufacturer's instructions, coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.
- 3.6 CLEANING
  - A. Remove temporary coverings and protection of surrounding areas and surfaces.
- 3.7 PROTECTION OF COATING SYSTEMS
  - A. Protect surfaces of coating systems from damage during construction.

END OF SECTION 09 97 35

## SECTION 10 11 00 - VISUAL DISPLAY UNITS

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Custom Tackable Surfaces.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Shop Drawings: For visual display units.
    - 1. Include plans, elevations, sections, details, and attachment to other work.
    - 2. Show locations of panel joints
  - C. Samples: For each type of visual display unit indicated.

# PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.2 TACKBOARD PANELS

- A. Tackboard Panels:
  - 1. Facing: 1/4-inch- thick, natural cork .
  - 2. Facing: Polyester fabric.
  - 3. Core: Manufacturer's standard.
- 2.3 MATERIALS
  - A. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish ; with surface-burning characteristics indicated.
  - B. Polyester Fabric: As indicated on Drawings.
  - C. Softwood Plywood: DOC PS 1.
  - D. Particleboard: ANSI A208.1, Grade M-1.

- E. MDF: ANSI A208.2, Grade 130.
- F. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.
- PART 3 EXECUTION
- 3.1 INSTALLATION
  - A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

END OF SECTION 10 11 00

SECTION 10 14 16 - PLAQUES

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section includes metal plaques.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Shop Drawings: For plaques.
    - 1. Include fabrication and installation details and attachments to other work.
    - 2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
    - 3. Show message list, typestyles, graphic elements, and layout for each plaque at least half size .
- PART 2 PRODUCTS
- 2.1 PERFORMANCE REQUIREMENTS
  - A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" the ABA standards of the Federal agency having jurisdiction and ICC A117.1.
- 2.2 PLAQUES
  - A. Cast Plaque : Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
    - 1. <u>Manufacturers</u>: 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. A.R.K. Ramos.
      - b. ACE Sign Systems, Inc.
      - c. Metallic Arts.
    - 2. Plaque Material: Cast aluminum .
    - 3. Plaque Thickness: 0.50 inch .
    - 4. Plaque Size: 18" x 20"
    - 5. Plaque Text: TBD by Owner.
    - 6. Edge: Similar to ARK Ramos #500.
    - 7. Finishes:
      - a. Integral Aluminum Finish: Clear anodized .
      - b. Overcoat: Manufacturer's standard baked-on clear coating .
    - 8. Background Texture: Leatherette .
    - 9. Integrally Cast Border Style: Plain bevel, polished .

PLAQUES

10. Mounting: Rosette-head through fasteners .

#### 2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
  - 3. Plaque Mounting Fasteners:
    - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.
    - b. Through Fasteners: Exposed metal fasteners matching plaque finish, with type of head indicated, installed in predrilled holes.
- B. Adhesive: As recommended by plaque manufacturer.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

#### 2.4 FABRICATION

- A. General: Provide manufacturer's standard plaques according to requirements indicated.
  - 1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  - 2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
  - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
  - 5. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Surface-Engraved Graphics: Machine-engrave characters and other graphic devices into indicated plaque surface to produce precisely formed copy, incised to uniform depth.
  - 1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
  - 2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
  - 3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
  - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
  - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
    - b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
  - 2. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
  - 3. Brackets: Remove loose debris from substrate surface and install bracket supports in position, so that plaque is correctly located and aligned.
  - 4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of plaque and of suitable quantity to support weight of plaque after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as plaque is applied and to prevent visibility of cured adhesive at plaque edges. Place plaque in position, and push to engage adhesive. Temporarily support plaque in position until adhesive fully sets.
- C. Remove temporary protective coverings and strippable films as plaques are installed.

END OF SECTION 10 14 16

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

## PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Cast dimensional characters.
    - 2. Cutout dimensional characters.

# 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements, and layout for each sign at least half size .
  - 4. Show locations of electrical service connections.
  - 5. Include diagrams for power, signal, and control wiring.

## PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
  - A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 2.2 DIMENSIONAL CHARACTERS
  - A. Cast Characters : Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
    - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
      - a. ASI Sign Systems, Inc.
    - 2. Character Material: Cast aluminum .
    - 3. Character Height: As indicated on Drawings .
    - 4. Finishes:
      - a. Overcoat: Manufacturer's standard baked-on clear coating.
    - 5. Mounting: As indicated on Drawings .
  - B. Cutout Characters : Characters with uniform faces; square-cut, smooth , eased edges; precisely formed lines and profiles; and as follows:
    - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:

- a. ASI Sign Systems, Inc.
- 2. Character Material: Sheet or plate stainless steel .
- 3. Character Height: As indicated on Drawings .
- 4. Thickness: Manufacturer's standard for size of character .
- 5. Finishes:
  - a. Overcoat: Manufacturer's standard baked-on clear coating.
- 6. Mounting: As indicated on Drawings .

#### 2.3 DIMENSIONAL CHARACTER MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 316, stretcher-leveled standard of flatness.

#### 2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
  - 3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
  - 4. Sign Mounting Fasteners:
    - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
    - b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
    - c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

#### 2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  - 2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
  - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

- 4. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
- 5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- 6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
  - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
  - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
  - 2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
    - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
  - 3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
  - 4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.

- 5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
- C. Remove temporary protective coverings and strippable films as signs are installed.

### END OF SECTION 10 14 19

SECTION 10 14 23.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section includes room-identification signs that are directly attached to the building.
  - B. Related Requirements:
    - 1. Section 10 14 16 "Plaques" for one-piece, solid metal signs, with or without frames, that are used for high-end room-identification.

# 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements , including raised characters and Braille, and layout for each sign at least half size .
- C. Samples: For each exposed product and for each color and texture specified.

#### 1.3 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

#### PART 2 - PRODUCTS

# 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction and ICC A117.1.
- 2.2 ROOM-IDENTIFICATION SIGNS
  - A. Room-Identification Sign : Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
    - 1. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      - a. ASI Sign Systems, Inc.
    - 2. Sign-Panel Perimeter: Finish edges smooth.
      - a. Corner Condition in Elevation: Square .

- 3. Frame: Entire perimeter .
  - a. Material: Aluminum .
  - b. Profile: Beveled .
  - c. Corner Condition in Elevation: Square .
  - d. Finish and Color: As selected by Architect from manufacturer's full range .
- 4. Mounting: Manufacturer's standard method for substrates indicated with adhesive two-face tape .
- 2.3 SIGN MATERIALS
  - A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- 2.4 ACCESSORIES
  - A. Adhesive: As recommended by sign manufacturer.
  - B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.
- 2.5 FABRICATION
  - A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
    - 1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
    - 2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
    - 3. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
  - B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
  - C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.

- 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Mounting Methods:
  - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
  - 2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
  - 3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
  - 4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

END OF SECTION 10 14 23.16

SECTION 10 21 13.13 - METAL TOILET COMPARTMENTS

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:1. Painted steel toilet compartments configured as toilet enclosures and urinal screens.

# 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

# 2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

#### 2.2 PAINTED STEEL TOILET COMPARTMENTS

- A. <u>Manufacturers:</u> 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. ASI Global Partitions; ASI Group.
  - 2. Bradley Corporation.
  - 3. Flush Metal Partition, LLC.
  - 4. General Partitions Mfg. Corp.
  - 5. Hadrian Manufacturing Inc.
  - 6. Metpar Corp.
- B. Toilet-Enclosure Style: Floor Anchored Overhead Braced .
- C. Urinal-Screen Style: Wall-Mounted .
- D. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
  - 1. Core Material: Manufacturer's standard sound-deadening honeycomb of resinimpregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and 1-1/4 inches for pilasters.

- 2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand applied downward load on grab bar of at least 250 lbf (1112 N), when tested according to ASTM F446, without deformation of panel.
- 3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
- E. Facing Sheets and Closures: hot-dip galvanized-steel sheet with nominal base-metal (uncoated) thicknesses as follows:
  - 1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.036 inch.
  - 2. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.048 inch.
  - 3. Panels: Manufacturer's standard thickness, but not less than 0.030 inch .
  - 4. Doors: Manufacturer's standard thickness, but not less than 0.030 inch.
- F. Pilaster Shoes and Sleeves (Caps): Stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- G. Brackets (Fittings):
  - 1. Stirrup Type: Ear or U-brackets; stainless steel .
  - 2. Continuous Type: Manufacturer's standard, stainless steel.
- H. Steel Sheet Finish: Manufacturer's standard baked-on finish.
  - 1. Color: As selected by Architect from manufacturer's full range .
    - a. Allow for application of one color in each room.
    - b. A different color will be specified / selected for Men's and Women's Restrooms.

# 2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
  - 1. Material: Stainless Steel. Zamac will not be accepted .
  - 2. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.
- 2.4 FABRICATION
  - A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.

- B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2 inch.
    - b. Panels and Walls: 1 inch.
  - 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
    - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
  - 3. Continuous Brackets: Secure Urinal Screens to walls with continuous brackets.

# 3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

# END OF SECTION 10 21 13.13

SECTION 10 26 00 - WALL AND DOOR PROTECTION

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Corner guards.

# B. Related Requirements:

- 1. Section 06 40 23 "Interior Architectural Woodwork for solid-wood handrails, bumper rails, chair rails, or corner moldings without plastic bumpers.
- 2. Section 08 71 00 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

# 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
  1. Include plans, elevations, sections, and attachment details.
- C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

#### 1.3 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and doorprotection units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

#### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.
- 2.2 CORNER GUARDS
  - A. Surface-Mounted, Opaque-Plastic Corner Guards CG1 : Fabricated as one piece from PETG ; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.
    - 1. Basis-of-Design Products: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
    - 2. Mounting: Adhesive.
    - 3. Color and Texture: As indicated by manufacturer's designations .

WALL AND DOOR PROTECTION

#### 2.3 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- Β. Adhesive: As recommended by protection product manufacturer.

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- Installation Quality: Install wall and door protection according to manufacturer's written Α. instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- Mounting Heights: Install wall and door protection in locations and at mounting heights Β. indicated on Drawings.

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END OF SECTION 10 26 00

project.(13619)

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Public-use washroom accessories.
    - 2. Childcare accessories.
    - 3. Custodial accessories.

# 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each finish specified, full size.
  - 1. Approved full-size Samples will be returned and may be used in the Work.

# 1.3 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.

# PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

# 2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Toilet Tissue (Roll) Dispenser :
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
    - a. Bobrick Washroom Equipment, Inc.
  - 2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset .
  - 3. Mounting: Surface mounted.
  - 4. Operation: Noncontrol delivery with standard spindle .
  - 5. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
  - 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

TOILET, BATH, AND LAUNDRY ACCESSORIES

- B. Paper Towel (Folded) Dispenser :
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
    - a. Bobrick Washroom Equipment, Inc.
  - 2. Mounting: Surface mounted.
  - 3. Minimum Capacity: 400 C-fold or 525 multifold towels .
  - 4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
  - 5. Lockset: Tumbler type.
  - 6. Refill Indicator: Pierced slots at sides or front.
- C. Combination Towel (Folded) Dispenser/Waste Receptacle :
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
    - a. Bobrick Washroom Equipment, Inc.
  - 2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
  - 3. Mounting: Semirecessed .
    - a. Designed for nominal 4-inch wall depth.
  - 4. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels .
  - 5. Minimum Waste-Receptacle Capacity: 4 gal. .
  - 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
  - 7. Liner: Reusable, vinyl waste-receptacle liner .
  - 8. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.
- D. Soap Dispenser :
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
    - a. Bobrick Washroom Equipment, Inc.
  - 2. Description: Designed for manual operation and dispensing soap in liquid or lotion lather form.
  - 3. Mounting: Vertically oriented, surface mounted.
  - 4. Refill Indicator: Window type.
- E. Grab Bar :

2.

- 1. <u>Manufacturers</u>: Subject to compliance with requirements, provide products by the following:
  - a. Bobrick Washroom Equipment, Inc.
  - Mounting: Flanges with concealed fasteners.
- 3. Material: Stainless steel, 0.05 inch thick.
  - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
- 4. Outside Diameter: 1-1/2 inches.
- 5. Configuration and Length: As indicated on Drawings .
- F. Sanitary-Napkin Disposal Unit :
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Bobrick Washroom Equipment, Inc.
- 2. Mounting: Surface mounted.
- 3. Door or Cover: Self-closing, disposal-opening cover.
- 4. Receptacle: Removable.
- 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- G. Mirror Unit :
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
    - a. Bobrick Washroom Equipment, Inc.
  - 2. Frame: Stainless steel angle, 0.05 inch thick .
    - a. Corners: Welded and ground smooth.
  - 3. Size: As indicated on Drawings .
  - 4. Hangers: Manufacturer's standard rigid, tamper and theft resistant .

# 2.3 CHILDCARE ACCESSORIES

- A. Diaper-Changing Station :
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
    - a. Koala Kare Products; a Division of Bobrick.
  - 2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
    - a. Engineered to support minimum of 250-lb static load when opened.
  - 3. Mounting: Semirecessed, with unit projecting not more than 1 inch from wall when closed.
  - 4. Operation: By pneumatic shock-absorbing mechanism.
  - 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin), exterior shell with rounded plastic corners; HDPE interior in manufacturer's standard color .
  - 6. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

# 2.4 CUSTODIAL ACCESSORIES

- A. Custodial Mop and Broom Holder :
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
    - a. Bobrick Washroom Equipment, Inc.
  - 2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
  - 3. Length: 36 inches .
  - 4. Hooks: Four .
  - 5. Mop/Broom Holders: Three , spring-loaded, rubber hat, cam type.
  - 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
    - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
    - b. Rod: Approximately 1/4-inch- diameter stainless steel.
- B. Custodial Paper Towel (Folded) Dispenser :

- 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
  - a. Bobrick Washroom Equipment, Inc.
- 2. Mounting: Surface mounted.
- 3. Minimum Capacity: 600 C-fold or 800 multifold towels .
- 4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- 5. Lockset: Tumbler type.
- 6. Refill Indicator: Pierced slots at sides or front.
- 2.5 FABRICATION
  - A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.
- PART 3 EXECUTION

# 3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
  - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.
- C. Shower Seats: Install to comply with specified structural-performance requirements.

END OF SECTION 10 28 00

## SECTION 10 44 13 - FIRE PROTECTION CABINETS

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Fire-protection cabinets for the following:
      - a. Portable fire extinguisher (Extinguishers provided by Owner (Cintas, 317-573-8160).

### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semi-recessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets.
  - 1. Include plans, elevations, sections, details, and attachments to other work.

## 1.3 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

#### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Activar Construction Products Group, Inc. JL Industries products as specified below or comparable products by one of the following.
  - 1. Guardian Fire Equipment, Inc.
  - 2. Modern Metal Products, Division of Technico Inc.
  - 3. Potter Roemer LLC; a Division of Morris Group International.
  - 4. Strike First Corporation of America (The).
- 2.2 FIRE-PROTECTION CABINET FEC-1
  - A. Flush Door, Continuous Hinge Cabinet: Suitable for fire extinguisher.

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- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Activar Construction Products Group, Inc. - JL Industries; Academy Series extinguisher or comparable product.
- 2. Cabinet Construction: Nonrated .
- 3. Cabinet Material: Aluminum sheet .
- 4. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
  - a. Rolled-Edge Trim: **3-inch** backbend depth.
- 5. Door Style: Fully glazed panel with frame .
- 6. Door Glazing: Tempered float glass (clear).
- 7. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  - a. Pull Handle: Recessed, flush.
  - b. Provide continuous hinge, of same material and finish as trim,, permitting door to open 180 degrees.
  - c. Door Lock: Pull handle with roller catch .

# 2.3 MATERIALS

- A. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
  - 1. Finish: Clear anodic .
- B. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).
- 2.4 FABRICATION
  - A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
    - 1. Weld joints and grind smooth.
    - 2. Miter corners and grind smooth.
    - 3. Provide factory-drilled mounting holes.
    - 4. Prepare doors and frames to receive locks.
    - 5. Install door locks at factory.
  - B. Cabinet Doors: Fabricate doors in accordance with manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
    - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
    - 2. Fabricate door frames of one-piece construction with edges flanged.
    - 3. Miter and weld perimeter door frames and grind smooth.
  - C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

# 2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

#### 3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:
  - 1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
  - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
  - 2. Provide inside latch and lock for break-glass panels.
  - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

#### 3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13
SECTION 10 53 00 - MANUFACTURED CANOPIES

PART 1 - Part 1: General

- 1.1 Description of Work
  - A. Work in this section includes furnishing and installation of extruded aluminum overhead hanger rod style canopies as manufactured by Mapes Industries Inc.
    - 1. Basis of Design Product: Lumishade.
  - B. Related Items and Considerations
    - 1. Flashing of various designs may be required. Generic flashing supplied by Mapes. Specialty flashing to be supplied by installer.
    - 2. Determine wall construction, make-up and thickness.
    - 3. Ensure adequate wall condition to carry canopy loads where required.
    - 4. Consider water drainage away from canopy where necessary.
    - 5. Any necessary removal or relocation of existing structures, obstructions or materials.
- 1.2 Submittals
  - A. Submit Shop Drawings indicating details of compliance with design intent and coordination with work of others, including secondary structural support members at engineered metal building system.
- 1.3 Quality Assurance
  - A. Products meeting these specifications established standard of quality required as manufactured by Mapes Industries, Inc. Lincoln, Nebraska 1-888-273-1132.
- 1.4 Field Measurement
  - A. Confirm dimensions prior to preparation of shop drawings when possible.
  - B. If requested, supply manufacturer s standard literature and specifications for canopies.
  - C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.
- 1.5 Performance Requirements
  - A. Canopy must conform to local building codes.
  - B. PE Stamped calculations are required and must be signed and sealed by an engineer licensed within the state canopy is installed.

- 1.6 Deliver, Storage, Handling
  - A. Deliver and store all canopy components in protected areas.

### PART 2 - PRODUCTS

- 2.1 Manufacturer
  - A. Mapes Canopies Lincoln, Nebraska Phone: 1-888-273-1132.Fax: 1-877-455-6572.

### 2.2 Materials

- A. Decking shall consist of 3" extruded flat soffit .078 decking.
- B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current Mapes brochures.
- C. Hanger rods and attachment hardware shall be a black painted finish.
- D. Fascia shall be standard extruded 8" J style.

### 2.3 Finishes

A. Finish type shall be 2-Coat Kynar Finish.1. Color: Custom matching "LiUNA Orange".

# 2.4 Fabrication

- A. All Mapes lumishade canopies are shipped with the materials precut to size for field assembly.
- B. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.
- C. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to Downspout From Fascia.

### PART 3 - EXECUTION

- 3.1 Inspection
  - A. Confirm that surrounding area is ready for the canopy installation.
  - B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by Mapes Industries.
  - C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed

# 3.2 Installation

- A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handling and erection.
- 3.3 After installation, entire system shall be left in a clean condition.

END OF SECTION 10 53 00

## SECTION 10 75 16 - GROUND-SET FLAGPOLES

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section includes ground-set flagpoles made from aluminum .
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
    - 1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
  - B. Delegated-Design Submittal: For flagpoles.
- 1.3 CLOSEOUT SUBMITTALS
  - A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
  - A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.
- 2.2 PERFORMANCE REQUIREMENTS
  - A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design flagpole assemblies.
  - B. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.

### 2.3 ALUMINUM FLAGPOLES

- A. Aluminum Flagpoles: Cone -tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Acme/Lingo Flagpoles, LLC.
    - b. American Flagpole.
    - c. Concord Industries, Inc.
    - d. Eder Flag Manufacturing Company, Inc.
    - e. Ewing Flagpoles.

- f. Pole-Tech Company Inc.
- g. U.S. Flag & Flagpole Supply, LP.
- B. Exposed Height: 20 feet and 25 feet .
- C. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch- diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.
- D. Sleeve for Aluminum Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.

### 2.4 FITTINGS

- A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
  - 1. 0.063-inch spun aluminum with gold anodic finish.
- B. Internal Halyard, Cam Cleat System: 5/16-inch- diameter, braided polypropylene halyard; cam cleat; and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
  1. Halyard Flag Snaps: Stainless-steel swivel snap hooks. Furnish two per halyard.
- 2.5 MISCELLANEOUS MATERIALS
  - A. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
  - B. Sand: ASTM C33/C33M, fine aggregate.
  - C. Elastomeric Joint Sealant: Single-component nonsag urethane joint sealant complying with requirements in Section 07 92 00 "Joint Sealants."
  - D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- 2.6 ALUMINUM FINISHES
  - A. Clear Anodic Finish: AAMA 611, AA-M12C22A41 .
- PART 3 EXECUTION
- 3.1 PREPARATION
  - A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- C. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.
- D. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.
- E. Place concrete, as specified in Section 03 30 00 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.
- F. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

### 3.2 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.
- B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 10 75 16

## SECTION 11 30 13 - RESIDENTIAL APPLIANCES

- PART 1 GENERAL
- 1.1 SUMMARY
  - A. Section Includes the following ADA appliances furnished by Owner and installed by the Contractor:
    - 1. Cooking appliances.
    - 2. Kitchen exhaust ventilation.
    - 3. Refrigeration appliances.
    - 4. Cleaning appliances.

# PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
  - A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 2.2 RANGES

- A. Electric Range Equipment Tag 225 : Free-standing range with one oven(s) and complying with AHAM ER-1.
  - 1. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide Frigidaire; FFEH3051VS Front Control Range or comparable product by one of the following:
    - a. Bosch. .
    - b. Frigidaire.
  - 2. Anti-Tip Device: Manufacturer's standard.

# 2.3 MICROWAVE OVENS

- A. Microwave Oven Equipment Tag #223 :
  - 1. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide Frigidaire; Model # FFMO1611LS 1.6 cuft 1100-Watt Countertop Microwave or comparable product by one of the following:
    - a. Bosch..
  - 2. Mounting: Base Cabinet niche .
  - 3. Material: Stainless steel .
- 2.4 KITCHEN EXHAUST VENTILATION
  - A. Overhead Exhaust Hood Equipment Tag #217 :
    - 1. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide Frigidaire; Model # FHWC3040MS 30-inch Stainless Steel Undercabinet Range Hood w/ Charcoal filter or comparable product by one of the following:
      - a. Bosch..

- 2. Type: Wall-mounted, exhaust-hood system.
- 3. Exhaust Fan: Three-speed fan built into hood and with manufacturer's standard 500-cfm capacity.
  - a. Venting: Nonvented, recirculating type with charcoal filter .
- 4. Finish: Stainless steel .

# 2.5 REFRIGERATOR/FREEZERS

- A. Refrigerator/Freezer Equipment Tag #221 : Side by Side Refirgerator with water and ice in the door.
  - 1. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide Frigidaire; FRSS2323 Side by Side or comparable product by one of the following:
    - a. Bosch. .
  - 2. Type: Freestanding .
  - 3. General Features:
    - a. Dispenser in door for ice and cold water with dispenser lock.
    - b. Interior light in refrigeration compartment.
    - c. Automatic defrost.
    - d. Interior light in freezer compartment.
    - e. Automatic icemaker and storage bin.
  - 4. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR productlabeling program.
  - 5. Front Panel(s): Stainless steel .

# 2.6 DISHWASHERS

- A. Dishwasher Equipment Tag #222 : .
  - 1. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide Bosch 800 Series Dishwasher SGX78B55UC ADA compliant 24" Stainless Steel Dishwasher or comparable product by one of the following:
    - a. Bosch US; BSH Home Appliances Corporation.
  - 2. Type: Built-in undercounter .
  - 3. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR productlabeling program.
  - 4. Front Panel: Stainless steel .

# PART 3 - EXECUTION

- 3.1 INSTALLATION
  - A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
  - B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

END OF SECTION 11 30 13

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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.
  - 2. Motor-operated roller shades with single rollers.
- B. Related Requirements:
  - 1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
  - 2. Section 07 92 00 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, 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 shadeband materials, their orientation to rollers, and their seam and batten locations.
  - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified, 10 inches long.
- D. Samples for Initial Selection: For each type and color of shadeband material.
  - 1. Include Samples of accessories involving color selection.
- E. Samples for Verification: For each type of roller shade.
  - 1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.
  - 2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
  - 3. Installation Accessories: Full-size unit, not less than 10 inches long.
- F. Product Schedule: For roller shades. Use same designations indicated on Drawings.

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- 1.4 INFORMATIONAL SUBMITTALS
  - A. Qualification Data: For Installer.
  - B. Product Certificates: For each type of shadeband material.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

### 1.6 MAINTENANCE MATERIAL SUBMITTALS

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

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
  - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### 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.

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## PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
  - A. Source Limitations: Obtain roller shades from single source from single manufacturer.

## 2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Draper Inc.; Manual FlexShade or a comparable product by one of the following:
  - 1. Hunter Douglas Contract.
  - 2. Lutron Electronics Co., Inc.
  - 3. MechoShade Systems, Inc.
- B. 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 Chains: Manufacturer's standard .
    - a. Loop Length: Full length of roller shade .
    - b. Limit Stops: Provide upper and lower ball stops.
    - c. Chain-Retainer Type: Clip, jamb mount .
  - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
    - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
  - 1. Roller Drive-End Location: To be determined during shop drawing review .
  - 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller .
  - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method .
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Shadebands:

2.

- 1. Shadeband Material: Light-filtering fabric .
  - Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
  - a. Type: Enclosed in sealed pocket of shadeband material .
    - b. Color and Finish: As indicated on the drawings .
- F. Installation Accessories:
  - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped .

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- b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches.
- 2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
  - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 3 inches .
- 3. Endcap Covers: To cover exposed endcaps.
- 4. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
  - a. Closure-Panel Width: 2 inches .
- 5. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
- 6. Installation Accessories Color and Finish: As selected from manufacturer's full range .

# 2.3 MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Draper Inc.; Motorized FlexShade or a comparable product by one of the following:
  - 1. Hunter Douglas Contract.
  - 2. Lutron Electronics Co., Inc.
  - 3. MechoShade Systems, Inc.
  - 4. OEM Shades Inc.
- B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
  - 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
    - a. Electrical Characteristics: 110-V ac .
    - b. Maximum Total Shade Width: As required to operate roller shades indicated .
    - c. Maximum Shade Drop: As required to operate roller shades indicated .
    - d. Maximum Weight Capacity: As required to operate roller shades indicated .
  - 3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
    - a. Group Control Station: Momentary-contact, three-position, rocker-style, wallswitch-operated control station with open, close, and center off functions for single-switch group control.
    - b. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.
    - c. Color: As indicated on the drawings .

# PRODUCT MASTERSPEC LICENSED BY DELTEK, INC. TO DRAPER INC.

- 4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
- 5. Operating Features:
  - a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
  - 1. Direction of Shadeband Roll: Regular, from back (exterior face) of roller .
  - 2. Shadeband-to-Roller Attachment: Manufacturer's standard method .
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.
- F. Shadebands:
  - 1. Shadeband Material: Light-filtering fabric .
  - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material .
    - b. Color and Finish: As indicated on the drawings .
- G. Installation Accessories:
  - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped .
    - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches .
  - 2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
    - a. Height: Manufacturer's standard in height required to enclose roller and shadeband assembly when shade is fully open, but not less than 3 inches.
  - 3. Endcap Covers: To cover exposed endcaps.
  - 4. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
    - a. Closure-Panel Width: 2 inches .
  - 5. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
  - 6. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
  - 7. Installation Accessories Color and Finish: As selected from manufacturer's full range .

PRODUCT MASTERSPEC LICENSED BY DELTEK, INC. TO DRAPER INC.

# 2.4 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701 . Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
  - 1. Fabric: As indicated on the drawings .
  - 2. Orientation on Shadeband: As indicated on Drawings .
  - 3. Openness Factor: 1 percent.
  - 4. Color: As indicated on Drawings .

# 2.5 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with 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, measured at 74 deg F:
  - Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
  - 2. 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. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
  - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
  - 2. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.
  - 3. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.

PRODUCT MASTERSPEC LICENSED BY DELTEK, INC. TO DRAPER INC.

- 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.
  - B. Electrical Connections: Connect motor-operated roller shades to building electrical system.
  - C. Roller Shade Locations: At exterior windows .

## 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, that ensure 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

# SECTION 12 32 16 - MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

## 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. Plastic-laminate-clad casework.
  - 2. Casework hardware and accessories.
- B. Related Requirements:
  - 1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood blocking for anchoring casework.
  - 2. Section 09 22 16 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.
  - 3. Section 09 65 13 "Resilient Base and Accessories" for resilient base applied to plasticlaminate-clad casework.
  - 4. Section 12 36 23.13 "Plastic-Laminate-Clad Countertops."

# 1.3 DEFINITIONS

A. Definitions in the AWI/AWMAC/WI's "Architectural Woodwork Standards" apply to the Work of this Section.

### 1.4 COORDINATION

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

### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For plastic-laminate-clad casework.
  - 1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
  - 2. Indicate types and sizes of casework.
  - 3. Show fabrication details, including types and locations of hardware.
  - 4. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and equipment.

# MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

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- 5. Apply AWI's Quality Certification Program label to Shop Drawings.
- C. Keying Schedule: Include schematic keying diagram, and index each key set to unique designations that are coordinated with the Contract Documents.
- D. Samples for Verification: For the following:
  - 1. Plastic Laminates: 8 by 10 inches , for each type, color, pattern, and surface finish required.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

# 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wetwork is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during remainder of construction period. Maintain temperature and relative humidity during remainder of construction period in range recommended for Project location by the AWI/AWMAC/WI's "Architectural Woodwork Standards."
- B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.
- C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

### 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Delamination of components or other failures of glue bond.
    - b. Warping of components.
    - c. Failure of operating hardware.
  - 2. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK 12 32 16 - 2

- 1. Case Systems Inc.
- 2. Stevens Industries, Inc.
- 3. TMI Systems Design Corporation.
- B. Source Limitations: Obtain from single source from single manufacturer.
- 2.2 GENERAL REQUIREMENTS FOR CASEWORK
  - A. Quality Standard: Unless otherwise indicated, comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.
    - 1. Grade: Custom .
  - B. Product Designations: Drawings indicate sizes, configurations, and finish materials of manufactured plastic-laminate-clad casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered. See Section 01 60 00 "Product Requirements."
- 2.3 PLASTIC-LAMINATE-CLAD CASEWORK
  - A. Design: Face-frame cabinet construction with the following door and drawer-front style:
    - 1. Flush overlay.
  - B. Grain Direction for Wood-Grain Plastic Laminate:
    - 1. Doors: Vertical with continuous vertical matching.
    - 2. Drawer Fronts: Vertical with continuous vertical matching .
    - 3. Face Frame Members: Lengthwise.
    - 4. End Panels: Vertical.
    - 5. Bottoms and Tops of Units: Side to side.
    - 6. Knee Space Panels: Vertical.
    - 7. Aprons: Horizontal.
  - C. Exposed Materials:
    - 1. Plastic-Laminate Grade: VGS.
      - a. Colors and Patterns: As indicated by manufacturer's designations .
    - 2. Edgebanding: PVC.
      - a. PVC Edgebanding Color: As selected by Architect from casework manufacturer's full range .
  - D. Semiexposed Materials:
    - 1. Plastic Laminate: Grade VGS unless otherwise indicated. Provide plastic laminate for semiexposed surfaces unless otherwise indicated.
      - a. Colors and Patterns: As indicated by manufacturer's designations .

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

- b. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.
- 2. Hardboard: Use only for cabinet backs where exterior side of back is not exposed.
- 3. Unless otherwise indicated, provide specified edgebanding on all semiexposed edges.
- E. Concealed Materials:
  - 1. Solid Wood: With no defects affecting strength or utility.
  - 2. Plywood: Hardwood plywood.
  - 3. Plastic Laminate: Grade BKL.
  - 4. Particleboard.
  - 5. MDF.
  - 6. Hardboard.

# 2.4 CABINET HARDWARE AND ACCESSORIES

- A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish , commercial-quality, heavy-duty hardware.
  - 1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.
- Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, Type B01602, self-closing.
  Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.
  - 1. Degrees of Opening: 135 degrees.
- C. Wire Pulls: Solid aluminum wire pulls, fastened from back with two screws.
  - 1. For sliding doors, provide recessed stainless steel flush pulls.
  - 2. Provide two pulls for drawers more than 24 inches wide.
- D. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.
  - 1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
  - 2. Drawers: Provide one bumper on back side of drawer front at each corner.
- E. Drawer Slides: ANSI/BHMA A156.9, Type B05091.
  - 1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full -extension type; zinc-plated, steel ball-bearing slides.
  - 2. Box Drawer Slides: Grade 1HD-100, for drawers not more than 6 inches high and 24 inches wide.
  - 3. File Drawer Slides: Grade 1HD-200, for drawers more than 6 inches high or 24 inches wide.
- F. Drawer and Hinged-Door Locks: Cylindrical (cam) type, five-pin tumbler, brass with chromeplated finish, and complying with ANSI/BHMA A156.11, Grade 1.
  - 1. Provide a minimum of two keys per lock and six master keys.
  - 2. Provide locks where indicated .

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- a. Masterkey for up to 500 key changes.
- G. Sliding-Door Hardware Sets: Manufacturer's standard, to suit type and size of sliding-door unit.
- H. Adjustable Shelf Supports: Two-pin-locking plastic shelf rests complying with ANSI/BHMA A156.9, Type B04013 .
- I. Adjustable Wall Shelf Standards, Shelf Rests for Standards and Fasteners:
  - 1. Basis-of-Design Shelf Standards: Knape and Vogt, No. 87 or comparable product by another manufacturer.
  - 2. Basis-of-Design Shelf Rests: Knape and Vogt, No. 186/187 or comparable product by another manufacturer.
  - 3. Basis-of-Design Shelf Fasteners: Knape and Vogt, No. 211 Fasteners with two screws into shelf and one into shelf rest.
- 2.5 MATERIALS
  - A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
  - B. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.
  - C. Softwood Plywood: DOC PS 1.
  - D. Particleboard: ANSI A208.1, Grade M-2.
  - E. Particleboard: Straw-based particleboard complying with ANSI A208.1, Grade M-2, except for density.
    - 1. Source Limitations: Obtain from single source from single manufacturer.
  - F. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.
  - G. Hardboard: ANSI A135.4, Class 1 tempered.
  - H. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
    - 1. Basis-of-Design Products: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
    - 2. Source Limitations: Obtain from single source from single manufacturer.
  - I. PVC Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, (3.0 mm) thick at doors and drawer fronts, (1.0 mm) thick elsewhere.
  - J. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamineimpregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
    - 1. Edgebanding for Thermoset Decorative Panels: PVC or polyester edgebanding matching thermoset decorative panels.

# 2.6 FABRICATION

- A. Plastic-Laminate-Clad Cabinet Construction: As required by referenced quality standard, but not less than the following:
  - 1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard.
  - 2. Shelves: 3/4-inch- thick particleboardfor cabients up to 30 inches wide,3/4-inch- thick plywood or 1-inch- thick particleboard for cabinets over 30 inches wide.
  - 3. Backs of Casework: 1/2-inch- thick particleboard or MDF where exposed, 1/4-inch- thick hardboard dadoed into sides, bottoms, and tops where not exposed.
  - 4. Drawer Fronts: 3/4-inch particleboard.
  - 5. Drawer Sides and Backs: 1/2-inch- thick particleboard or MDF, with glued dovetail or multiple-dowel joints.
  - 6. Drawer Bottoms: 1/2-inch- thick particleboard or MDF glued and dadoed into front, back, and sides of drawers.
  - 7. Doors: 3/4 inch thick, with particleboard or MDF cores.
  - 8. Doors More Than 48 Inches High: cores.
- B. Filler Strips: Provide as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as casework.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

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

# 3.2 INSTALLATION

- A. Grade: Install casework to comply with same quality standard grade as item to be installed.
- B. Install casework level, plumb, and true in line; shim as required using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.
- D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten cabinets to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch.

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- E. Fasten casework to adjacent units and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards."
- F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- G. Adjust operating hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

# 3.3 CLEANING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 12 32 16

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# SECTION 12 36 23.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:1. Plastic-laminate-clad countertops.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Shop Drawings: For plastic-laminate-clad countertops.1. Apply AWI Quality Certification Program label to Shop Drawings.
  - C. Samples: Plastic laminates in each type, color, pattern, and surface finish required.
- 1.3 INFORMATIONAL SUBMITTALS
  - A. Product Certificates: For the following:
    - 1. Composite wood products.
    - 2. High-pressure decorative laminate.
    - 3. Adhesives.
  - B. Quality Standard Compliance Certificates: AWI Quality Certification Program .
- PART 2 PRODUCTS
- 2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS
  - A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.
  - B. Grade: Custom .
  - C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS .
    - 1. Basis-of-Design Products: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
  - D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
    - 1. As indicated by manufacturer's designations on Drawings.
  - E. Edge Treatment: 3.0-mm PVC edging on all exposed edges.
    - 1. Color: To match laminate top.

- F. Core Material: Particleboard .
- G. Core Thickness: 1-1/8 inch.
- H. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.
- 2.2 WOOD MATERIALS
  - A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
  - B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
    - 1. Particleboard: ANSI A208.1, Grade M-2.

# 2.3 ACCESSORIES

- A. Grommets for Cable Passage through Countertops:
  - 1. 2 ½ inch OD, molded plastic grommets and matching plastic caps with slot for wire passage.
  - 2. Basis-of-Design: EDP series by Doug Mockett and Company, Inc.
    - a. Color: Navy Grey (92N)
  - 3. Coordinate grommet locations with the Owner in the field prior to drilling the countertop and installation.
  - 4. Provide 1 grommet at each power receptacle location and data receptacle location or combined power and data location.
- B. Counter Support Brackets:
  - 1. Basis-of-Design: Rakks, EH-Surface Mount Counter Support Bracket sized per manufacturer's recommendations based on counter depth.
    - a. Counter support brackets should be spaced a maximum of 32" O.C.
    - b. As Selected by Architect from Manufacturers standard colors.

## 2.4 MISCELLANEOUS MATERIALS

- A. Adhesive for Bonding Plastic Laminate: PVA .
  - 1. Adhesive for Bonding Edges: PVA.
    - a. Edges to be machine applied.

### 2.5 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
  - 1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

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B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

# PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
  - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
  - 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
  - 1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
  - 2. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
- F. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 12 36 23.13

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# SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Solid surface material countertops.
  - 2. Solid surface material backsplashes.
  - 3. Solid surface material end splashes.
  - 4. Solid surface material apron fronts.
  - 5. Solid surface material sinks.
  - 6. Solid surface window stools.
  - 7. Solid surface wall caps.

### 1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials and sinks.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples: For each type of material exposed to view.

### PART 2 - PRODUCTS

## 2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
  - 1. Basis-of-Design Products: Provide products by manufacturer identified the Interior Finish Legend on the Drawings.
  - 2. Type: Provide Standard type unless Special Purpose type is indicated.
  - 3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
  - 4. Colors and Patterns: As indicated by manufacturer's designations .
- B. Particleboard: ANSI A208.1, Grade M-2.
- C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
  - 1. For use at sink locations.

### 2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
  - 1. Grade: Custom .

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- B. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.
  - 1. Includes window stools and wall caps.
- C. Backsplashes: 1/2-inch- thick, solid surface material.
- D. Joints: Fabricate countertops in sections for joining in field.
- 2.3 INSTALLATION MATERIALS
  - A. Adhesive: Product recommended by solid surface material manufacturer.
  - B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."
- PART 3 EXECUTION
- 3.1 INSTALLATION
  - A. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
  - B. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions.
  - C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
  - D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.
  - E. Install aprons to backing and countertops with adhesive.
  - F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
  - G. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.16

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## SECTION 13 34 19 - METAL BUILDING SYSTEMS

### PART 1 - GENERAL

- 1.1 Section Includes:
  - A. Metal building systems including:
    - 1. Metal framing components.
    - 2. Metal wall panels and trim.
    - 3. Metal roof panels and trim.
    - 4. Metal building accessories.
- 1.2 Related Sections:
  - A. Section 07 92 00 Joint Sealants.
  - B. Section 03 30 00 Cast-In-Place Concrete: Concrete slabs and footings.
  - C. Section 05 12 00 Structural Metal Framing: Secondary canopy steel (channels).
  - D. Section 05 40 00 Cold-Formed Metal Framing: Metal partition wall framing.

#### 1.3 References

- A. American Institute of Steel Construction (AISC):
  - 1. AISC 360 Specification for Structural Steel Buildings, June 22, 2010.
  - 2. AISC 341 AISC Seismic Provisions for Structural Steel Buildings, June 22nd, 2010.
  - 3. AISC 303 Code of Standard Practice for Steel Buildings and Bridges, April 14th, 2010.
- B. American Iron and Steel Institute (AISI) :
  - 1. AISI S100 North American Specification for the Design of Cold-Formed Steel Structural Members, 2012 Edition.
- C. American Welding Society (AWS)
  - 1. AWS D1.1/D1.1M Structural Welding Code Steel, 2010.
  - 2. AWS D1.3/D1.3M Structural Welding Code Sheet Steel, 2008
- D. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):
- E. ASHRAE 90.1-2013 Energy Standard for Buildings Except Low-Rise Residential Buildings (I-P Edition).
- F. ASTM International (ASTM): Latest versions of:
  - 1. ASTM A 36/A 36M Standard Specification for Carbon Structural Steel.
  - 2. ASTM A 475 Standard Specification for Zinc-Coated Steel Wire Strand.
  - 3. ASTM A 500/A 500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

- 4. ASTM A 529/A 529M Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
- 5. ASTM A 563 Standard Specification for Carbon and Alloy Steel Nuts.
- 6. ASTM A 572/A 572M Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
- 7. ASTM A 653/A 653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- 8. ASTM A 792/A 792M Standard Specification for Steel Sheet, 55 Percent Aluminum-Zinc Alloy-Coated by Hot-Dip Process.
- 9. ASTM A 992/A 992M Standard Specification for Structural Steel Shapes.
- 10. ASTM A 1011/A 1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy and High-Strength Low-Alloy with Improved Formability and Ultra-High Strength
- 11. ASTM A 1018/A 1018A Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- 12. ASTM C 518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- 13. ASTM C 1363 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
- 14. ASTM D 635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- 15. ASTM D 1003 Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
- 16. ASTM D 1494 Standard Test Method for Diffuse Light Transmission Factor of Reinforced Plastics Panels.
- 17. ASTM D 1929 Standard Test Method for Determining Ignition Temperature of Plastics.
- 18. ASTM D 2240 Standard Test Method for Rubber Property—Durometer Hardness.
- 19. ASTM D 2244 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
- 20. ASTM D 4214 Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
- 21. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- 22. ASTM E 72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
- 23. ASTM E 283 Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across Specimen.
- 24. ASTM E 331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- 25. ASTM E 1592 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
- 26. ASTM E 1646 Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.

- 27. ASTM E 1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
- 28. ASTM E 1980 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- 29. ASTM F 436 Standard Specification for Hardened Steel Washers
- 30. ASTM F 1941 Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))
- 31. ASTM F 3125 Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
- G. Cool Roof Rating Council (CRRC):
  - 1. ANSI/CRRC S100 Standard Test Methods for Determining Radiative Properties of Materials, April 26th, 2016.
- H. Factory Mutual Approvals (FM Approvals):
  - 1. FM 4471 Approval Standard for Class 1 Panel Roofs.
  - 2. FM 4880 Approval Standard for Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings and Exterior Wall Systems.
  - 3. FM 4881 Approval Standard for Class 1 Exterior Wall Systems.
- I. FM Global:
  - 1. FM 1-28 Property Loss Prevention Data Sheet 1-28, Wind Design, October 2015.
- J. International Accreditation Service (IAS):
- K. Accreditation Criteria 472 (AC472) Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, April 2017
- L. International Standards Organization (ISO)
  - 1. ISO 14044 Environmental management -- Life Cycle Assessment -- Requirements and Guidelines, 2006
  - 2. ISO 21930 Sustainability in Building Construction -- Environmental Declaration of Building Products, 2007.
- M. Metal Building Manufacturers Association (MBMA):
  - 1. Metal Building Systems Manual, 2012 Edition.
- N. National Fenestration Rating Council (NFRC):
  - 1. NFRC 100 Procedure for Determining Fenestration Product U-factors, 2014
  - 2. NFRC 200 Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence, 2010.
- O. National Fire Protection Association (NFPA):
  - 1. NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components, 2012 Edition.

- P. Research Council on Structural Connections (RCSC):
  - 1. Specification for Structural Joints Using High Strength Bolts, August 1, 2014.
- Q. Underwriters Laboratories (UL):
  - 1. UL-580 Tests for Uplift Resistance of Roof Assemblies.
  - 2. UL-790 Standard Test Methods for Fire Tests of Roof Coverings.
  - 3. UL-2218 Impact Resistance of Prepared Roof Covering Materials.
- 1.4 Administrative Requirements
  - A. Pre-installation Meeting: Prior to erection of framing, conduct pre-installation meeting at site attended by Owner, Architect, manufacturer's technical representative, inspection agency and related trade contractors.
  - B. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.
- 1.5 Definitions
  - A. Traditional Metal Building System: Building system using either continuous or simple span "Z" purlins for support of roof covering material.
  - B. Long Bay System (LBS): Building system using simple span, cold-formed, open web purlins to support roof covering material.
  - C. Gable Symmetrical: Continuous frame building with ridge in center of building, consisting of tapered or straight columns and tapered or straight rafters. Sidewall girts may be continuous (by-passing columns) or simple span (flush in column line). Rafters may or may not have interior columns.
  - D. Gable Unsymmetrical: Continuous frame building with an off-center ridge, consisting of tapered or straight columns and tapered or straight rafters. Eave height and roof slope may differ on each side of ridge. Sidewall girts may be continuous (by-passing columns) or simple span (flush in column line). Rafters may or may not have interior columns.
  - E. Single Slope: Continuous frame building which does not contain ridge, but consists of one continuous slope from side to side. Building consists of straight or tapered columns and tapered or straight rafters. Sidewall girts may be continuous (by-passing columns) or simple span (flush in column line). Rafters may or may not have interior columns.
  - F. Lean-to (LT): Building extension, which does not contain ridge, but consists of one continuous slope from side to side, usually with same roof slope and girt design as building to which attached.
  - G. Roof Slope: Pitch expressed as inches of rise for each 12 inches (305 mm) of horizontal run.

- H. Acrylic-Coated Galvalume: Aluminum-Zinc coated steel with a thin clear acrylic finish coating eliminating the need for roll-forming oil and reducing incidence of field marking by handling or foot traffic.
- I. Building Eave Height: Nominal dimension measured from finished floor to top flange of eave strut.
- J. Building Width: Measured from outside to outside of side wall secondary structural member.
- K. Building Length: Measured from outside to outside of end wall secondary structural member.
- L. Auxiliary Loads: Dynamic loads induced by cranes, conveyors, or material handling systems.
- M. Collateral Loads: Weight of any non-moving equipment or material, such as ceilings, electrical or mechanical equipment, sprinkler systems, plumbing, or ceilings.
- N. Dead Load: Actual weight of building system as supplied by manufacturer supported by given member.
- O. Floor Live Loads: Loads induced on floor system by building occupants and possessions including but not limited to furniture and equipment.
- P. Roof Live Loads: Loads produced by maintenance activities, rain, erection activities, and or movable or moving loads but not including wind, snow, seismic, crane, or dead loads.
- Q. Roof Snow Loads: Gravity load induced by weight of snow or ice on roof, assumed to act on horizontal projection of roof.
- R. Seismic Loads: Loads acting in any direction on structural system due to action of an earthquake.
- S. Wind Loads: Loads on structure induced by forces of wind blowing from any horizontal direction.
- 1.6 Design Requirements
  - A. Governing Design Code: Structural design for the metal building system shall be performed by the manufacturer of the metal building system in accordance with the building code provided in the contract documents.
  - B. Design Basis:
  - C. Use standards, specifications, recommendations, findings, and interpretations of professionally recognized groups as basis for establishing design, drafting, fabrication, and quality criteria, practices, and tolerances, including the AISC Code of Standard Practice for Steel Buildings and Bridges.

- D. Design structures in accordance with MBMA Practices and Manual including fabrication and erection tolerances.
- E. Design structural mill sections and welded plate sections in accordance with AISC 360, ASD Method.
- F. Design the lateral force resisting systems and related components for seismic loads in accordance with AISC 341.
- G. Design cold-formed steel structural members and panels in accordance with AISI S-100.
- H. Design all bolted joints in accordance with RCSC Specification.
- I. Design Loads:
- J. In accordance with Contract Documents and manufacturer's standard design practices.
- K. Design loads include dead loads, roof live loads, wind loads, seismic loads, collateral loads, auxiliary loads, floor live loads and applied or specified loads.
- 1.7 Submittals
  - A. Submittals for Review:
  - B. Shop Drawings:
    - 1. Complete erection drawings with identification and assembly of building components.
    - 2. Show anchor bolt settings, transverse cross-sections, sidewall, endwall, and roof framing, flashing and sheeting, and accessory installation details.
    - 3. Bear seal and signature of Registered Professional Engineer responsible for metal building system design in accordance with state law.
  - C. Manufacturer installation manual showing:
    - 1. Preparation instructions and recommendations.
    - 2. Storage and handling requirements and recommendations.
    - 3. Installation methods.
  - D. Structural Design Calculations: sealed and signed by a professional engineer licensed in accordance with applicable state law.
  - E. Buy American/ARRA Compliance Letter of Certification.
  - F. Documentation including test reports supporting Thermal Transmission Coefficients (Ufactors) and Solar Heat Gain Coefficients (SHGC; for non-opaque components only) of building envelope components specified in this section.
  - G. Samples:
    - 1. Submit color chips showing manufacturer's full range of available colors and patterns for each finish product.

- 2. After color selection submit samples representing actual product, color, and patterns.
- H. Quality Control Submittals:
  - 1. IAS AC472 Certificate for each facility involved in the design and fabrication of the Metal Building System.
  - 2. Certified Erector Certificate issued to the erector by the manufacturer.
- I. Material Test Reports (MTR) for all steel material used in the manufacture of primary and secondary framing members, panels and bolts specified in this section and when required by ASTM A 6/A 6M
- 1.8 Quality Assurance
  - A. Manufacturer and Fabricator Qualifications: Primary products furnished by single IAS AC472 accredited manufacturer/fabricator with minimum 5 years of experience.
  - B. Erector Qualifications:
    - 1. Single installer with minimum 5 years of experience in installing products of same or similar type and scope.
  - C. Installer must be certified by the metal building manufacturer.
- 1.9 Delivery, Storage and Handling
  - A. Store packaged products in original, unopened packaging until ready for installation.
  - B. Store and dispose of solvent-based materials and materials used with solvent-based materials in accordance with requirements of the authority having jurisdiction.
  - C. Protect steel products from weather as specified by manufacturer instructions.
- 1.10 Project Conditions
  - A. Do not install systems when temperature, humidity, or ventilation is outside of limits recommended by manufacturer.
- 1.11 Warranties
  - A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal building system components that fail in materials and workmanship within one year from date of Substantial Completion.
  - B. Special Weathertightness Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal building system components that fail to remain weathertight, including leaks, without monetary limitation within 20 years from date of Substantial Completion.

- C. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within the specified number years from date of Substantial Completion, including:
- D. Acrylic Coated Galvalume (Galvalume<sup>®</sup> Plus): Product will not rupture, fail structurally, or perforate within period of 20 years due to normal atmospheric corrosion.
- E. Fluoropolymer Two-Coat System (PVDF):
  - 1. Color fading in excess of 5 Hunter units per ASTM D 2244 for 30 years.
  - 2. Chalking in excess of No. 8 rating per ASTM D 4214 for 30 years.
  - 3. Failure of adhesion, peeling, checking, or cracking for 40 years.
- F. Metallic Fluropolymer Two-Coat System (Metallic PVDF):
  - 1. Chalking in excess of No. 6 rating per ASTM D 4214 for 25 years.
  - 2. Failure of adhesion, peeling, checking, or cracking for 25 years.

### PART 2 - Products

- 2.1 Manufacturers
  - A. Basis of Design Manufacturer: Ceco Building Systems (www.cecobuildings.com).
  - B. Substitutions: Not permitted.
- 2.2 Materials
  - A. Buy American Act/American Reinvestment and Recovery Act (ARRA) requirements: Provide materials in compliance with the following requirements:
    - 1. Buy American Act of 1933 BAA-41 U.S.C §§ 10a 10d for non-ferrous products.
    - 2. Buy American provisions of Section 1605 of the American Recovery and Reinvestment Act of 2009 (ARRA), for ferrous products.
  - B. Primary Framing Steel:
    - 1. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 75 percent.
  - C. Hot-rolled shapes: ASTM A 36 or ASTM A 992, minimum yield of 36 ksi (248 MPa) or 50 ksi (345 MPa).
  - D. Built-up sections:
    - 1. Webs:
      - a. ASTM A 1011 or ASTM A1018, SS or HSLAS, Grade 55 (380) for webs 3/16 inch (4.76 mm) thick and thinner.
      - b. ASTM A 572 Grade 50 (340) or ASTM A572 Grade 55 (380) or ASTM A 529 Grade 55 for webs thicker than 3/16 inch (4.76 mm).
    - 2. Flanges: ASTM A 529 Grade 55 (380) or ASTM A 572 Grade 50 (340) or 55 (380).
  - E. Round tube: ASTM A 500, Grade B or C with minimum yield strength of 42 ksi (290 MPa).
- F. Square and rectangular tube: ASTM A 500, Grade B or C, minimum yield strength of 42 ksi (290 MPa).
- G. Cold-formed C sections: ASTM A 1011, Grade 55 (380), or ASTM A 653, Grade 55 (380).
- H. X-bracing: ASTM A 529 or A 572 for rod bracing 36 ksi (248 MPa) or 50 ksi (345 MPa), ASTM A 36 for angle bracing or ASTM A 475 for cable bracing.
- I. Secondary Framing Steel:
  - 1. Purlins, girts, and eave struts: ASTM A 1011 Grade 55 (380), or ASTM A 653, Grade 55 (380).
    - a. Recycled Content: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
    - b. Thickness: As required to achieve performance criteria indicated in this section and on the drawings.
    - c. Finish: Gray Shop Coat. Shop coat only intended to provide temporary protection during transportation and erection.
- J. Panels:
  - 1. Materials: ASTM A 792.
  - 2. Thickness and yield strength:
    - a. 26 gauge: 0.0172 inch (0.437 mm) minimum uncoated thickness, 80 ksi (550 MPa) yield strength.
    - b. 24 gauge: 0.0212 inch (0.538 mm) minimum uncoated thickness, 50 ksi (340 MPa) yield strength.
    - c. 22 gauge: 0.0272 inch (0.690 mm) minimum uncoated thickness, 50 ksi (380 MPa) yield strength.
  - 3. Finishes:
    - a. Galvalume: Aluminum-Zinc Alloy Coating, 55% Aluminum, 50% Zinc coated steel per ASTM A 792 AZ55.
    - B. Galvalume<sup>®</sup> Plus: Acrylic-Coated Aluminum-Zinc Alloy Coating, 55% Aluminum, 50% Zinc coated steel per ASTM A 792 AZ55 with acrylic finish with no added lubricant.
  - 4. Exterior Paint:
    - a. Fluoropolymer Two-Coat System (PVDF): 0.2 0.3 mil primer with 0.7 0.8 mil 70 percent PVDF fluoropolymer color coat. Basis of Design: Signature 300.
  - 5. Interior Paint: 0.5 mil total dry film thickness consisting of primer coat and wash coat of manufacturer's standard light-colored acrylic or polyester backer finish.
- K. Fasteners:
  - 1. Through-fastened panels: Self-drilling with sealing washer.
  - 2. Standing seam panels: Long life self-drilling with sealing washer.
  - 3. Ridge: Long-life self-drilling with sealing washer.
  - 4. Clips to purlin or bar joists: Long-life self-drilling with hex washer head and washer.
- L. Clips:

- 1. Low or high fixed clips: Use where moderate thermal expansion and contraction in roof panel is expected.
- 2. Low or high sliding clips: Provide 2 to 4 inches of travel for panel thermal expansion and contraction.
- M. Sealants and closures:
  - 1. Side-laps: Factory applied, hot melt, foamable mastic.
  - 2. End-laps, eave, ridge assembly, gable flashings: Field-applied non-skinning sealant as specified in Section 07 92 00
  - 3. Standing Seam Roof Closures:
    - a. Outside closures: 24 gauge steel sheet.
    - b. Inside closures: 18 gauge Galvalume or G-40 galvanized coated steel complying with ASTM A 653/A 653M.
  - 4. Through-Fastened Roof Closures: Provide closed-cell polyethylene inside [and outside] foam closures.
    - a. Bulk Density: 2 pounds per cubic foot.
    - b. Service Temperature: -100 to 180 degrees Fahrenheit.
    - c. Shore Hardness: 7 on AA scale or 51 on 00 scale when tested to ASTM D 2240.
- 2.3 Primary Framing
  - A. Frame Design: Gable Symmetrical .
  - B. Sidewall Column Profile: Tapered or Prismatic .
  - C. Frame Span: Modular or Clear Span as indicated on Drawings .
  - D. Modular Frame Interior Column Profile: H Shape, Round Pipe, or Tube] Round PipeorTube Sections .
  - E. Bracing: Standard X-Bracing or Portal Frames as allowed by accessories .
- 2.4 Secondary Framing
  - A. Roof Zee Purlins:
    - 1. Horizontal structural members which support roof coverings.
    - 2. Depth: As required by design, 8 inches minimum.
    - 3. Thickness: As required by design, 16 gauge minimum.
    - 4. Finish: Red Oxide Gray shop coat. Shop coat only intended to provide temporary protection during transportation and erection.
  - B. Long Bay Purlins:
    - 1. Horizontal structural members that support roof systems, with virtual square shaped top and bottom chords and web members.
    - 2. Open Web Purlins for Long Bay applications.
    - 3. Finish: Gray shop coat. Shop coat only intended to provide temporary protection during transportation and erection.

- C. Wall Zee Girts:
  - 1. Horizontal structural members that support vertical panels.
  - 2. Depth: As required by design, 8 inches (203 mm) minimum.
  - 3. Gauge: As required by design, 16 gauge (0.056 inch (1.424 mm) minimum uncoated thickness).
  - 4. Finish: Gray shop coat. Shop coat only intended to provide temporary protection during transportation and erection.
- D. Spandrel Beams: ASTM A 36/A 36M or ASTM A 992/A 992M wide flange shapes, minimum yield 50 ksi for support of wall systems provided by others, as required by design.
- 2.5 Bolts
  - A. Rigid Frame Connections: Provide High Strength Bolts, Nuts and Washers:
    - 1. Bolts: ASTM F 3125 Grade A325 Heavy Hex Structural Type I.
    - 2. Washers: ASTM F 436 Type 1 Hardened Steel .
    - 3. Nuts: ASTM A 563 Grade C Heavy Hex. Nuts shall be wax coated by emulsion such that the torque required to complete a Rotational Capacity (RC) test shall be reduced by 40% from the un-waxed state.
    - 4. Coating: ASTM F 1941 Electrodeposited Yellow Zinc .
  - B. Other Connections: Provide High Strength or Machine Bolts as required by manufacturer design:
    - 1. High Strength Bolts and Nuts:
      - a. Bolts: ASTM F 3125 Grade A325 Heavy Hex Structural Type I.
      - b. Nuts: ASTM A 563 Grade C Heavy Hex.
      - c. Coating: ASTM F 1941 Electrodeposited Yellow Zinc.
    - 2. Machine Bolts:
      - a. Bolts: ASTM A 307 Grade Carbon Steel.
      - b. Nuts: ASTM A 563 Grade A Hex Nut.
      - c. Coating: ASTM F 1941 Electrodeposited Clear Zinc.
- 2.6 Roof Systems
  - A. Assembly Performance Requirements: Provide roof products and assemblies meeting the following requirements:
    - 1. Class 90 rated and listed in accordance with UL-580 for Wind Uplift.
    - 2. Class A rated and listed in accordance with UL-790 for External Fire.
    - 3. Class 4 rated and listed in accordance with UL-2218 for Impact Resistance.
  - B. Through-Fastened Panels:
    - 1. Type: Single skin ribbed panels with exposed fasteners.
    - 2. Strength: Determine and certify allowable panel strengths in accordance with AISI S100.
  - C. Panel profile(s): PBR; 1-1/4 inch (32 mm) ribs at 12 inch (305 mm) centers, 1/2:12 minimum roof slope.
    - 1. Thickness: [26 gauge] [24 gauge] [22 gauge]

- 2. Finish: [Galvalume<sup>®</sup> Plus] [SMP] [PVDF] [PVDF Metallic]
- 3. Color: [Selected from manufacturer standard colors] [As shown on drawings].
- 4. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 1680 at a pressure differential of +/- 1.57 psf (75 Pa).
- 5. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 1646 at a 20 psf (955 Pa) pressure differential when sprayed with 5 gallons of water per hour per square foot (203 liters per square meter) of specimen area.
- 6. FM Approvals Rating: Provide FM 4471 Approved assemblies on the basis of the following ratings. Identify materials with FM Approvals markings:
  - a. External Fire: Class A.
  - b. Internal Fire: Class 1.
  - c. Hail: Severe.
  - d. Wind: [1-60] [1-75] [1-90] [1-120] [As determined by FM 1-28]
- D. Panel fasteners: [Long-life finish.] [410 Series stainless steel] [300 Series stainless steel].
- E. Sidelap mastic: [1 inch x 3/32 inch (25 mm x 2.4 mm)] [1/2 inch x 3/32 inch (13 mm x 2.4 mm)].
- F. Standing Seam Panels:
  - 1. Type: Single skin panels with concealed clips.
  - 2. Panel Strength: Determine and certify panel strength as follows:
    - a. Positive Loading (Toward Panel Supports): Determine in accordance with AISI S100.
    - b. Negative Loading (Away from Panel Supports): Determine in accordance with ASTM E 1592.
- G. Panel profile: Double-Lok:
  - 1. Panel Type: Trapezoidal machine seamed, 1/4:12 minimum roof slope.
  - Panel width: [24 inches wide x 3 inches high (610 mm wide x 76 mm high)] [24 inches wide x 3 inches high (610 mm wide x 76 mm high)] [18 inches wide x 3 inches high (457 mm wide x 76 mm high)] [12 inches wide x 3 inches high (305 mm wide x 76 mm high)].
  - 3. Thickness: [24 gauge] [22 gauge].
  - 4. Finish: [Galvalume<sup>®</sup> Plus] [PVDF] [SMP] [PVDF Metallic].
  - 5. Color: [Selected from manufacturer standard colors] [As shown on drawings].
  - Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 1680 at a pressure differential of +/- 1.57 psf (75 Pa).
  - 7. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 1646 at a 20 psf (955 Pa) pressure differential when sprayed with 5 gallons of water per hour per square foot (203 liters per square meter) of specimen area.
  - 8. FM Approvals Rating: Provide FM 4471 Approved assemblies on the basis of the following ratings. Identify materials with FM Approvals markings:
    - a. External Fire: Class A.
    - b. Internal Fire: Class 1.

- c. Hail: Severe.
- d. Wind: [1-60] [1-75] [1-90] [1-120] [As determined by FM 1-28]
- H. Panel clips: [As required by design and insulation requirements] [High Floating Clips] [Low Floating Clips] [High Sliding Clips] [Low Sliding Clips].
- I. Thermal spacers: As Required for insulation system and panel clip.
- J. Through-Fastened Roof LTP: Provide [**single**] [**double**] layer LTP that match the profile of the roof panel.
- K. Standing Seam Roof LTP: Provide [single] [double] layer [field-located] [factory-assembled] LTP.
- L. Accessories
  - 1. Pipe flashing: [\_\_\_\_].
  - 2. Roof curbs: [\_\_\_\_].
  - 3. Roof Vents:
    - a. Source: [By metal building system manufacturer] [\_\_\_\_].
    - b. Type: [12 inches x 10 feet (305 mm x 3.05 m) ridge gravity] [20 inch (508 mm) round gravity] [24 inch (610 mm) round gravity] [Include operable dampers].
    - c. Finish: [Unpainted Galvalume<sup>®</sup>] [Prefinished white] [Field paint over white] [\_\_\_\_].
- M. Eave trim condition: Standard gutters and downspouts .
- 2.7 Wall, Liner, Soffit, and Fascia Panel Systems
  - A. Assembly Performance Requirements: Provide assemblies that function as exterior walls that meet the following requirements:
    - 1. Air Infiltration: Maximum air infiltration of 0.04 cubic feet per minute per square foot of specimen area when tested to ASTM E 283 at a pressure differential of +/- 1.57 psf (75 Pa).
    - 2. Water Infiltration: No uncontrollable water leakage when tested to ASTM E 331 at a 6.24 psf pressure differential when sprayed with 5 gallons of water per hour per square foot of specimen area.
  - B. Through-Fastened Panels:
    - 1. Panel type: Single skin ribbed panels with exposed fasteners.
    - 2. Panel Strength: Determine in accordance with AISI S100.
  - C. Panel profiles:
    - 1. PBR: 12 inch x 1 inch (305 mm x 25 mm) Rib. 1-1/4 inch (32 mm) ribs x 12 inch (305 mm) centers.
    - 2. 7.2: 1-1/2 inch (39 mm) ribs x 7.2 inch (183 mm) centers.
  - D. Thickness: 24 gauge.

- E. Finish: PVDF .
- F. Color: As shown on drawings.
- G. Panel fasteners: Long-life finish .
- H. Color: [Selected from manufacturer standard colors] [As shown on drawings].
- I. Panel fasteners: Long-life finish .
- J. Accessories:
  - 1. Base condition:
    - a. Formed base: Pre-finished bronze, self-flashing, for through-fastened panels.
    - b. Base member: [Angle] [Channel] [Girt].
    - c. Base member flashing: [Drip] [Masonry] [As indicated on Drawings].
  - 2. Framed openings:
    - a. Finish: [Match girt finish] [Pre-Galvanized].
    - b. Framed opening trim: Standard trim plus full cover trim on exposed jambs and headers.
  - 3. Trim profiles: Manufacturer's standard profiles [As indicated on Drawings].
    - a. Wall Light Transmitting Panels (LTP):
- K. Material: Provide UV-resistant, [Chopped Glass] [Woven Roving] fiber-reinforced acrylic LTP meeting the following requirements:
  - 1. Self-Ignition Temperature: 650 degrees Fahrenheit (343 degrees Celsius) when tested in accordance with ASTM D 1929.
  - 2. Diffuse Light Transmission: Not less than 50% when tested to ASTM D 1494.
  - 3. Burn Rate: Less than 2.5 inches per minute when tested in accordance with ASTM D 635.
  - 4. Smoke Developed Index: Not greater than 450 when tested in accordance with ASTM E 84.
  - 5. Haze Value: Nor less than 90% when tested in accordance with ASTM D 1003.
  - 6. Thermal Transmission: Provide U-Factor determined by ASTM C 1363 conducted in accordance with ASHRAE 90.1 Section A9.3.2 or by Finite Element Modeling per ASHRAE 90.1 Section A9.4
  - 7. Solar Heat Gain Coefficient: Provide SHGC determined by NFRC 200.
  - 8. Through-Fastened wall LTP: Provide [**single**] [**double**] layer LTP that match the profile of the wall panel.
- L. Walk Doors:
  - 1. Provided by Section 08 11 13 Hollow Metal Doors and Frames.
  - 2. Frame type: Framed openings.
- M. Windows:
  - 1. See Section 08 41 13 Aluminum-Framed Entrances and Storefronts
  - 2. Source: Specified in other sections .
- N. Louvers:

- 1. Source:
- 3. Type: [Fixed] [Adjustable].
- 4. Frame type: [Self framing] [Framed openings].
- 5. Finish: [Match adjacent wall color] [\_\_\_\_].
- 2.8 Fabrication
  - A. General:
    - 1. Shop-fabricate framing members for field bolted assembly.
    - 2. Surfaces of bolted connections: Smooth and free from burrs and distortions.
    - 3. Shop connections to conform to manufacturer's standard design practices.
    - 4. Mark framing members with identifying mark.
    - 5. Welding to conform to AWS D1.1 and AWS D1.3 as applicable.
  - B. Primary Framing:
    - 1. Plates, stiffeners, and related members: Factory welded base plates, splice plates, cap plates, and stiffeners into place on structural members.
    - 2. Bolt holes and related machining: Shop fabricate base plates, splices and flanges to include bolt connection holes. Shop-fabricate webs to include bracing holes.
    - 3. Secondary structural connections (purlins and girts): Ordinary (not pretensioned) bolted connections with welded clips.
    - 4. Welding inspection: Per IAS AC472 Part A.
  - C. Long Bay Purlins:
    - 1. Fabricate purlins from cold-formed open web long bay system assemblies with stiffened chords.
    - 2. Install connection bolts through purlin seats.
    - 3. Pre-punch assemblies to allow for attachment of frame flange brace angles, compression strut extensions, and diagonal X-bridging at centerline.
    - 4. Furnish bridging as light-gauge cold-formed angles secured using self-drilling fasteners.
    - 5. Manufacture sections in IAS AC472 Part A and B Accredited facility.
    - 6. Top and bottom chords: Nominal 4 inch (102 mm) width formed so that top surface is continuous and flat to facilitate easy assembly of roof system.
    - 7. Fabricate all elements of minimum 16 gauge steel.
    - 8. Subject finished assemblies to periodic testing to loads equal to 110 percent of design loads.
  - D. Zee Purlins:
    - 1. Fabricate purlins from cold-formed Z-shaped sections with stiffened flanges.
    - 2. Size flange stiffeners to comply with requirements of AISI S100.
    - 3. Purlin flanges unequal in width for easier nesting during erection.
    - 4. Purlins pre-punched at factory to provide for field bolting to rigid frame clips.
  - E. Eave Struts:

- 1. Fabricate eave struts from cold-formed unsymmetrical C-shaped sections with stiffened flanges.
- 2. Size flange stiffeners to comply with requirements of AISI S100.
- 3. No welded splices permitted.
- 4. Eave Struts pre-punched at factory to provide for field bolting to rigid frame clips.
- F. Girts: Simple or continuous span as required by design. Connection bolts will install through webs not flanges.

# G. Bracing:

- 1. Diagonal Bracing:
  - a. Diagonal bracing in roof and sidewalls may be used to resist longitudinal loads in structure when panel diaphragm cannot be used.
  - b. Furnish to length and equipped with hillside washers and nuts at each end.
  - c. Bracing may consist of rods threaded at each end or galvanized cable with suitable threaded end anchors.
  - d. If load requirements dictate, bracing may be of structural angle or pipe, bolted in place.
- 2. Special Bracing:
  - a. When diagonal bracing is not permitted in sidewall use rigid frame type portal or fixed base column.
  - b. Shear walls may be used where adequate to resist applied wind or seismic forces.
- 3. Flange Braces: Brace compression flange of primary framing laterally with angles connecting to purlin or girt webs so that flange compressive stress is within allowable limits for any combination of loading.

# H. Bridging:

- 1. Laterally brace top chord of long bay purlins with horizontal bridging if roof system being used will not supply adequate lateral support to top chord.
- 2. Horizontally bridge bottom chord for lateral bracing. One row of bolted diagonal bridging required for long span purlins 40 feet (12 192 mm) long and longer.
- I. Standing Seam Panels:
  - 1. Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles and structural requirements.
  - 2. Fabricate metal joints configured to accept applied sealant providing weathertight seal and preventing metal to metal contact and minimizing noise resulting from thermal movement.
  - 3. Fabricate panels in continuous lengths for full length of detailed runs, except where otherwise indicated on drawings.
  - 4. Sheet Metal Flashing and Trim: Fabricate or install flashing and trim to comply with manufacturer's written instructions and construction drawings.
  - 5. Configure Ultra-Dek and Double-Lok panels with interlocking edges with factory applied hot-melt mastic inside female seam. Female side snaps over male side (Ultra-Dek) and when seamed (Double-Lok) creates continuous lock, forming 360 degree Pittsburgh seam.

- 6. Notch Ultra-Dek and Double-Lok panels at factory at both ends so that field installation can commence or terminate from either end of building.
- 7. Maximum panel length: 45 feet (13 716 mm) unless otherwise indicated.
- 8. End Laps:
  - a. Fabricate with 16 gauge backup plates and eight end lap joint fasteners installed in six pre-punched holes in flat and in dimples in trapezoidal legs.
  - b. Apply mastic between panels and secure with self-drilling fasteners through panels and backup plate.
  - c. Through roof fasteners may be used only at end laps and eaves.

# PART 3 - Execution

- 3.1 Preparation
  - A. Clean surfaces prior to installation.
  - B. Prepare surfaces using methods recommended by manufacturer for best result for substrate.
- 3.2 Installation
  - A. Install system in accordance with manufacturer's instructions and approved Shop Drawings.
  - B. Fit members square against abutting components.
  - C. Position members plumb, square, and level.
  - D. Temporarily brace members until permanently fastened.
  - E. Do not splice load bearing members.
  - F. Align and adjust various members forming parts of a complete frame or structure after assembly but before fastening.
  - G. Welding to conform to AWS D1.1.
  - H. Fasten panels to supports.
  - I. Install trim to maintain visual continuity of system.
  - J. Install joint sealant and gaskets to prevent water penetration.
  - K. Flash penetrations through roofing with metal trim to match panels
- 3.3 Protection
  - A. Protect installed products until completion of project.

# 3.4 Adjustment

A. Touch up, repair, or replace damaged products before Substantial Completion.

END OF SECTION 13 34 19

# I 21 DIVISION

# SECTION 21 05 00 - BASIC FIRE PROTECTION MATERIALS AND METHODS

## PART 1 - GENERAL

# 1.1 RELATED SECTIONS

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 21, 22 and 23 Specification Sections, apply to work of this Section.
- B. This section applies to Division 21, 22 and 23 Specification Sections.
- C. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:
  - 1. Fire protection equipment nameplate data.
  - 2. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection).
  - 3. Miscellaneous metals for support of mechanical materials and equipment.
  - 4. Joint sealers for sealing around mechanical materials and equipment.

# 1.2 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
  - 1. Product data for the following products:
    - a. Joint sealers.
  - 2. Shop drawings detailing fabrication and installation for metal fabrications, supports and anchorage for mechanical materials and equipment.
  - 3. Coordination drawings for access panel and door locations.

# 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer for the installation and application joint sealers, access panels and doors.
- B. Quality welding processes and welding operators in accordance with AWS D1.1
  "Structural Welding Code Steel."

# 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

# 1.5 PROJECT CONDITIONS

- A. Conditions Affecting Selective Demolition: The following project conditions apply:
  - 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
  - 2. Locate, identify, and protect mechanical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
- B. Conditions Affecting Excavations: The following project conditions apply:
  - 1. Maintain and protect existing building services which transit the area affected by selective demolition.
  - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
  - 3. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.
  - 4. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.
  - 5. Remove existing underground utilities indicated to be removed.
    - a. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.
    - b. Provide temporary utility services to affected areas. Provide minimum of 14 days notice to Architect prior to utility interruption.
- C. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

## 1.6 SEQUENCE AND SCHEDULING

- A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.
- B. Notify the Owner at least 7 days prior to commencing demolition operations.
- C. Perform demolition in phases as indicated.

# PART 2 - PRODUCTS

- 2.1 FIRE PROTECTION NAMEPLATE DATA
  - A. Nameplate: For each piece of power operated fire protection equipment, provide a permanent operations data nameplate indicating manufacture, project name, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

# 2.2 SOIL MATERIALS

- A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone or natural or crushed sand.
- B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve.
- C. Backfill and Fill Materials: Materials complying with ASTM D 2487 soil classification groups GW, and SW; free of clay, rock, or gravel larger than 2 inches in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

#### 2.3 MISCELLANEOUS METALS

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold-Formed Steel Tubing: ASTM A 500.
- C. Hot-Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.
- E. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, recommended for interior and exterior applications.
- F. Fasteners: Zinc-coated, type, grade, and class as required.

## 2.4 JOINT SEALERS

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Architect from manufacture's standard colors.
- C. Elastomeric Joint Sealers: Provide the following types:
  - 1. Acrylic-emulsion sealants: One-part, non-sag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.
  - 2. Fire barrier penetration seals are specified in Section 07 84 00 Fire Stopping.

#### PART 3 - EXECUTION

- 3.1 EXAMINATION
  - A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

## 3.2 PREPARATION FOR JOINT SEALERS

- A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
- B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer.
  Protect adjacent areas from spillage and migration of primers, using masking tape.
  Remove tape immediately after tooling without disturbing joint seal.

#### 3.3 SELECTIVE DEMOLITION

- A. General: Demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- B. Materials and Equipment To Be Salvaged: Remove, demount, and disconnect existing mechanical materials and equipment indicated to be removed and salvaged and return materials and equipment to the Owner or location designated for storage.
- C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.

## 3.4 EXCAVATION

- A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.
- B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
  - 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
- C. Install sediment and erosion control measures in accordance with local codes and ordinances.
- D. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.
  - 1. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- E. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
- F. Trenching: Excavate trenches for mechanical installations as follows:
  - 1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearance on both sides of pipe and equipment.
  - 2. Limit the length of open trench to that in which pipe can be installed, tested, and the trench backfilled within the same day.
  - Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe.
     Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and pipe.
  - 4. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.
    - a. For pipes or equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom 1/4 of the circumference. Fill unevenness with tamped sand backfill. At each pipe joint over-excavate to relieve the bell or pipe joint of the pipe of loads, and to ensure continuous bearing of the pipe barrel on the bearing surface.
- G. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F (1 deg 2 C).

- H. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
  - 1. Under walks and pavements, use a combination of sub base materials and excavated or borrowed materials.
  - 2. Under building slabs, use drainage fill materials.
  - 3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
  - 4. For piping less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of piping, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
- I. Backfill excavations as promptly as work permits, but not until completion of the following:
  - 1. Inspection, testing, approval, and locations of underground utilities have been recorded.
  - 2. Removal of concrete formwork.
  - 3. Removal of shoring and bracing, and backfilling of voids.
  - 4. Removal of trash and debris.
- J. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- L. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- M. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.
  - 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesion-less soils).
    - a. Areas under structure, building slabs, steps and pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90

percent maximum density for cohesive material, or 95 percent relative density for cohesion-less material.

- b. Areas under walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesion-less material.
- N. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- O. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

# 3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."
- 3.6 APPLICATION OF JOINT SEALERS
  - A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
    - 1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
    - 2. Comply with recommendations of ASTM C 790 for use of acrylic- emulsion joint sealants.
  - B. Tooling: Immediately after sealant application and prior to time shining or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contract and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
  - C. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around mechanical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

# 3.7 INSTALLATION OF ACCESS DOORS

- A. Set frames accurately in position and securely attached to supports with face panels plumb and level in relation to adjacent finished surfaces.
- B. Adjust hardware and panels after installation for proper operation.

# END OF SECTION 21 05 00

# SECTION 21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

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

#### 1.3 ACTION SUBMITTALS

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

# 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.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

# 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Stainless steel.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

# 2.3 SLEEVE-SEAL FITTINGS

A. 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.

# 2.4 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-inch 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 inches 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 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "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 Division 07 Section "Penetration Firestopping."

# 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

# 3.3 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.

# 3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. 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-inch 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-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 2. Concrete Slabs-on-Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch 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 21 05 17

# SECTION 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
  - A. Section Includes:
    - 1. Escutcheons.
    - 2. Floor plates.

#### 1.3 ACTION SUBMITTALS

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

#### PART 2 - PRODUCTS

#### 2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip fasteners.

## 2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

#### ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

## PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass or split-casting brass type with polished, chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
    - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated rough-brass finish.
    - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or splitplate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
    - j. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated rough-brass finish.
    - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
  - 2. Escutcheons for Existing Piping:
    - a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.

- b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
- c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
- e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
- g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated rough-brass finish.
- h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
- i. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chromeplated rough-brass finish.
- j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor-plate type.
  - 2. Existing Piping: Split-casting, floor-plate type.

# 3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 21 05 18

#### SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipes, fittings, and specialties.
  - 2. Fire-protection valves.
  - 3. Sprinklers.

#### 1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig (1200 kPa) maximum.

#### 1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Sprinkler system design shall be approved by authorities having jurisdiction.
  - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.

- 2. Sprinkler Occupancy Hazard Classifications:
  - a. Building Service Areas: Ordinary Hazard, Group 1.
  - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1
  - c. General Storage Areas: Ordinary Hazard, Group 1.
  - d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
  - e. Office and Public Areas: Light Hazard.
- 3. Minimum Density for Automatic-Sprinkler Piping Design:
  - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft.
  - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft.
- 4. Maximum Protection Area per Sprinkler: Per UL listing.
- 5. Maximum Protection Area per Sprinkler:
  - a. Office Spaces: 225 sq. ft.
  - b. Storage Areas: 130 sq. ft.
  - c. Mechanical Equipment Rooms: 130 sq. ft.
  - d. Electrical Equipment Rooms: 130 sq. ft.
  - e. Other Areas: Per NFPA 13 recommendations unless otherwise indicated.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined per NFPA 13 and ASCE/SEI 7.

#### 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

# 1.7 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from all other installers.
- B. Qualification Data: For qualified Installer and professional engineer.

- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- D. Welding certificates.
- E. Fire-hydrant flow test report.
- F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- G. Field quality-control reports.

# 1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

# 1.9 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a. Engineering responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13, "Installation of Sprinkler Systems."

#### 1.10 PROJECT CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
  - 1. Notify Construction Manager and Owner no fewer than two weeks in advance of proposed interruption of sprinkler service.
  - 2. Do not proceed with interruption of sprinkler service without Construction Manager's Owner's written permission.

## 1.11 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

#### 1.12 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. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

## PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

#### 2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Galvanized and Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

- C. Thinwall Galvanized- and Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250), plain end.
- E. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- F. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.
- G. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- H. Malleable- or Ductile-Iron Unions: UL 860.
- I. Cast-Iron Flanges: ASME 16.1, Class 125.
- J. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- K. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- L. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
    - a. Anvil International, Inc.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.
  - 2. Pressure Rating: 175 psig minimum.
  - 3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
  - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

# 2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
  - 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
  - 2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

#### 2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
  - 1. Valves shall be UL listed or FM approved.
  - 2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.

#### 2.5 SPRINKLER SPECIALTY PIPE FITTINGS

- A. Branch Outlet Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. National Fittings, Inc.
    - c. Tyco Fire & Building Products LP.
    - d. Victaulic Company.
  - 2. Standard: UL 213.
  - 3. Pressure Rating: 175 psig minimum.
  - 4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
  - 5. Type: Mechanical-T and -cross fittings.
  - 6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
  - 7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
  - 8. Branch Outlets: Grooved, plain-end pipe, or threaded.

- B. Adjustable Drop Nipples:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CECA, LLC.
    - b. Corcoran Piping System Co.
    - c. Merit Manufacturing; a division of Anvil International, Inc.
  - 2. Standard: UL 1474.
  - 3. Pressure Rating: 250 psig minimum.
  - 4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
  - 5. Size: Same as connected piping.
  - 6. Length: Adjustable.
  - 7. Inlet and Outlet: Threaded.
- C. Flexible, Sprinkler Hose Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fivalco Inc.
    - b. FlexHead Industries, Inc.
    - c. Gateway Tubing, Inc.
  - 2. Standard: UL 1474.
  - 3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
  - 4. Pressure Rating: 175 psig minimum.
  - 5. Size: Same as connected piping, for sprinkler.

#### 2.6 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Globe Fire Sprinkler Corporation.
  - 2. Reliable Automatic Sprinkler Co., Inc.
  - 3. Tyco Fire & Building Products LP.
  - 4. Victaulic Company.
  - 5. Viking Corporation.
- B. General Requirements:
  - 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.

- 2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
- 3. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
  - 1. Early-Suppression, Fast-Response Applications: UL 1767.
  - 2. Nonresidential Applications: UL 199.
  - 3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes:
  - 1. Chrome plated.
  - 2. Bronze.
  - 3. Painted.
- E. Special Coatings:
  - 1. Wax.
  - 2. Lead.
  - 3. Corrosion-resistant paint.
- F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
  - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- G. Sprinkler Guards:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Reliable Automatic Sprinkler Co., Inc.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.
    - d. Viking Corporation.
  - 2. Standard: UL 199.
  - 3. Type: Wire cage with fastening device for attaching to sprinkler.
### PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

### 3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- K. Install alarm devices in piping systems.

- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- M. Fill sprinkler system piping with water.
- N. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Division 21 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Division 21 Section "Fire-Suppression Systems Insulation."
- O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 21 Section "Escutcheons for Fire-Suppression Piping."

### 3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.

- 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
  - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.4 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

## 3.5 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

# 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Coordinate with fire-alarm tests. Operate as required.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.7 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

### 3.8 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
  - 1. Standard-weight or Schedule 40, black-steel pipe with threaded ends; uncoated, grayiron threaded fittings; and threaded joints.
  - 2. Standard-weight or Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.

- 3. Standard-weight or Schedule 40, black-steel pipe with plain ends; uncoated, plain-endpipe fittings; and twist-locked joints.
- 4. Standard-weight or Schedule 40, galvanized-steel pipe with plain ends; galvanized, plainend-pipe fittings; and twist-locked joints.
- 5. Standard-weight or Schedule 40, black-steel pipe with cut or roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- 6. Standard-weight or Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- 7. Standard-weight or Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 8, shall be the following:
  - 1. Standard-weight or Schedule 10, black-steel pipe with threaded ends; uncoated, grayiron threaded fittings; and threaded joints.
  - 2. Standard-weight or Schedule 10, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
  - 3. Standard-weight or Schedule 10, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  - 4. Standard-weight or Schedule 10, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  - 5. Standard-weight or Schedule 10, black-steel pipe with plain ends; steel welding fittings; and welded joints.

# 3.9 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
  - 1. Rooms without Ceilings: Upright sprinklers.
  - 2. Rooms with Suspended Ceilings: Concealed sprinklers.
  - 3. Wall Mounting: Sidewall sprinklers.
  - 4. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
  - 1. Concealed Sprinklers: Rough brass, with factory-painted cover plate to match the adjacent surface.

2. Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13

# DIVISION 22

# SECTION 22 05 00 - BASIC PLUMBING MATERIALS AND METHODS

### PART 1 - GENERAL

### 1.1 RELATED SECTIONS

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and Division 21, 22 and 23 Specification Sections, apply to work of this Section.
- B. This section applies to Division 21, 22 and 23 Specification Sections.
- C. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:
  - 1. Plumbing equipment nameplate data.
  - 2. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection).
  - 3. Miscellaneous metals for support of mechanical materials and equipment.
  - 4. Joint sealers for sealing around mechanical materials and equipment.

### 1.2 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
  - 1. Product data for the following products:
    - a. Joint sealers.
    - b. Access doors.
  - 2. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.
  - 3. Coordination drawings for access panel and door locations.

### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer for the installation and application joint sealers, access panels and doors.
- B. Quality welding processes and welding operators in accordance with AWS D1.1
  "Structural Welding Code Steel."

- C. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.
  - 1. Provide UL Label on each fire-rated access door.

# 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

# 1.5 PROJECT CONDITIONS

- A. Conditions Affecting Selective Demolition: The following project conditions apply:
  - 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
  - 2. Locate, identify, and protect mechanical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
- B. Conditions Affecting Excavations: The following project conditions apply:
  - 1. Maintain and protect existing building services which transit the area affected by selective demolition.
  - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
  - 3. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.
  - 4. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.
  - 5. Remove existing underground utilities indicated to be removed.

- a. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.
- b. Provide temporary utility services to affected areas. Provide minimum of 48-hour notice to Architect prior to utility interruption.
- C. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

# 1.6 SEQUENCE AND SCHEDULING

- A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.
- B. Notify the Architect at least 5 days prior to commencing demolition operations.
- C. Perform demolition in phases as indicated.

### PART 2 - PRODUCTS

- 2.1 PLUMBING EQUIPMENT NAMEPLATE DATA
  - A. Nameplate: For each piece of power operated mechanical equipment, provide a permanent operations data nameplate indicating manufacture, project name, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

### 2.2 SOIL MATERIALS

- A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.
- B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve.
- C. Backfill and Fill Materials: Materials complying with ASTM D 2487 soil classification groups GW, GP, GM, SW, and SP; free of clay, rock, or gravel larger than 2 inches in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

# 2.3 MISCELLANEOUS METALS

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold-Formed Steel Tubing: ASTM A 500.

- C. Hot-Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.
- E. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, recommended for interior and exterior applications.
- F. Fasteners: Zinc-coated, type, grade, and class as required.

# 2.4 JOINT SEALERS

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Architect from manufacture's standard colors.
- C. Elastomeric Joint Sealers: Provide the following types:
  - 1. Acrylic-emulsion sealants: One-part, non-sag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.
  - 2. Fire barrier penetration seals are specified in Section 07 84 00 Fire Stopping.
- D. Access Doors and Frames:
  - 1. Flush, un-insulated, fire rated and non-fire rated access doors and frames with exposed trim: Fabricated from metallic-coated steel sheet. Joints and seams shall be continuously welded steel with welds ground smooth and flush with adjacent surfaces
  - 2. Frames:
    - a. For installation in masonry, concrete, ceramic tile, or wood paneling wall surfaces, 1" wide exposed perimeter flange and adjustable masonry anchors.
    - b. For installation in gypsum wallboard or plaster wall surfaces, perforated flanges with wall board bead.
    - c. For full bed plaster applications, galvanized expanded metal lath and exposed casing bead welded to the perimeter of the frame.
    - d. For installation in gypsum wallboard ceilings, flush access panels and trimless frames.
    - e. Fire-Resistance Rating: Provide rating same as wall or ceiling for which access door is indicated on drawings.

- 3. Doors:
  - a. Door: Minimum 0.060-inch-thick sheet metal, flush construction with concealed spring hinges or continuous piano hinge set to open 175 degrees, factory prime painted.
  - b. Fire Rated Doors: Insulated flush panel doors with continuous piano hinge and self-closing mechanism.
  - c. Latch: Self-latching bolt operated by flush key with interior release.
  - d. Prepared to receive mortise cylinder lock, specified in Division 8 Section "Door Hardware," with interior release.
  - e. Flush, screwdriver-operated cam locks.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.
- 3.2 PREPARATION FOR JOINT SEALERS
  - A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
  - B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer.
    Protect adjacent areas from spillage and migration of primers, using masking tape.
    Remove tape immediately after tooling without disturbing joint seal.

### 3.3 SELECTIVE DEMOLITION

- A. General: Demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- B. Materials and Equipment To Be Salvaged: Remove, demount, and disconnect existing mechanical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
- C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.

### 3.4 EXCAVATION

A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.

- B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
  - 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
- C. Install sediment and erosion control measures in accordance with local codes and ordinances.
- D. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.
  - 1. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- E. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
- F. Trenching: Excavate trenches for plumbing installations as follows:
  - 1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearance on both sides of pipe and equipment.
  - 2. Limit the length of open trench to that in which pipe can be installed, tested, and the trench backfilled within the same day.
  - Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe.
     Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and pipe.
  - 4. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.
    - a. For pipes or equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom 1/4 of the circumference. Fill unevenness with tamped sand backfill. At each pipe joint over-excavate to relieve the bell or pipe joint of the pipe of loads, and to ensure continuous bearing of the pipe barrel on the bearing surface.
- G. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F (1 deg 2 C).

- H. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
  - 1. Under walks and pavements, use a combination of sub base materials and excavated or borrowed materials.
  - 2. Under building slabs, use drainage fill materials.
  - 3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
  - 4. For piping less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of piping, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
- I. Backfill excavations as promptly as work permits, but not until completion of the following:
  - 1. Inspection, testing, approval, and locations of underground utilities have been recorded.
  - 2. Removal of concrete formwork.
  - 3. Removal of shoring and bracing, and backfilling of voids.
  - 4. Removal of trash and debris.
- J. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- K. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- L. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- M. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.
  - 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesion-less soils).

- a. Areas under structure, building slabs, steps and pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesion-less material.
- b. Areas under walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesion-less material.
- N. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- O. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

# 3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

# 3.6 APPLICATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
  - 1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
  - 2. Comply with recommendations of ASTM C 790 for use of acrylic- emulsion joint sealants.
- B. Tooling: Immediately after sealant application and prior to time shining or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contract and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- C. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around mechanical services penetrating floors

and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

# 3.7 INSTALLATION OF ACCESS DOORS

- A. Set frames accurately in position and securely attached to supports with face panels plumb and level in relation to adjacent finished surfaces.
- B. Adjust hardware and panels after installation for proper operation.

END OF SECTION 22 05 00

# SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

# PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

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

### 1.3 ACTION SUBMITTALS

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

# 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.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- F. Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

- G. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- H. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

### 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Stainless steel.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

### 2.3 SLEEVE-SEAL FITTINGS

A. 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.

# 2.4 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-inch 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 inches 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 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "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 Division 07 Section "Penetration Firestopping."

# 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

# 3.3 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.

### 3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system or PVC wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch 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 or PVC wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 2. Concrete Slabs-on-Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Interior Partitions:
    - a. Piping Smaller Than NPS 6: Galvanized-Steel-Sheet Sleeves or Steel-Sheet Sleeves
    - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 22 05 17

# SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING

### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Bimetallic-actuated thermometers.
  - 2. Liquid-in-glass thermometers.
  - 3. Light-activated thermometers.
  - 4. Thermowells.
  - 5. Dial-type pressure gages.
  - 6. Gage attachments.
  - 7. Test plugs.
  - 8. Test-plug kits.

### B. Related Sections:

- 1. Division 22 Section "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
- 2. Division 22 Section "Domestic Water Piping" for water meters inside the building.

### 1.3 ACTION SUBMITTALS

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

### 1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

# PART 2 - PRODUCTS

# 2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Ashcroft, Inc.
    - b. Trerice, H. O. Co.
    - c. Weiss Instruments, Inc.
  - 2. Standard: ASME B40.200.
  - 3. Case: Cast aluminum, 6-inch nominal size.
  - 4. Case Form: Back angle unless otherwise indicated.
  - 5. Tube: Glass with magnifying lens and blue or red organic liquid.
  - 6. Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in deg F.
  - 7. Window: Glass or plastic.
  - 8. Stem: Aluminum or brass and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  - 9. Connector: 3/4 inch with ASME B1.1 screw threads.
  - 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

# 2.2 THERMOWELLS

- A. Thermowells:
  - 1. Standard: ASME B40.200.
  - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
  - 3. Material for Use with Copper Tubing: CNR or CUNI.
  - 4. Type: Stepped shank unless straight or tapered shank is indicated.
  - 5. External Threads: NPS 1/2, NPS 3/4, or NPS 1 ASME B1.20.1 pipe threads.
  - 6. Internal Threads: 1/2, 3/4, and 1 inch with ASME B1.1 screw threads.
  - 7. Bore: Diameter required to match thermometer bulb or stem.
  - 8. Insertion Length: Length required to match thermometer bulb or stem.
  - 9. Lagging Extension: Include on thermowells for insulated piping and tubing.
  - 10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

# 2.3 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Ashcroft Inc.
    - b. Trerice, H. O. Co.
    - c. Weiss Instruments, Inc.
  - 2. Standard: ASME B40.100.
  - 3. Case: Liquid-filled, sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
  - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  - 5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 7. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi.
  - 8. Pointer: Dark-colored metal.
  - 9. Window: Glass.
  - 10. Ring: Metal.
  - 11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

# 2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

# 2.5 TEST PLUGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Ashcroft, Inc.
  - 2. Trerice, H. O. Co.
  - 3. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

- D. Thread Size: NPS 1/4 (DN 8), ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: EPDM self-sealing rubber.

# 2.6 TEST-PLUG KITS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Ashcroft, Inc.
  - 2. Trerice, H. O. Co.
  - 3. Weiss Instruments, Inc.
- B. Furnish one test-plug kit containing one thermometer, one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. High-Range Thermometer: Small, bimetallic insertion type with 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.
- D. Pressure Gage: Small, Bourdon-tube insertion type with 2-inch diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- E. Carrying Case: Metal or plastic, with formed instrument padding.

# PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

- G. Install remote-mounted pressure gages on panel.
- H. Install valve and snubber in piping for each pressure gage for fluids.
- I. Install test plugs in piping tees.
- J. Install thermometers in the following locations:
  - 1. Inlet and outlet of each water heater.
  - 2. Outlet of each thermostatic mixing valve.
- K. Install pressure gages in the following locations:
  - 1. Building water service entrance into building.
  - 2. Inlet and outlet of each thermostatic mixing valve.

# 3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

# 3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

# 3.4 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

# 3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 100 psi.

# END OF SECTION 22 05 19

# 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.
  - B. Related Sections:
    - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
    - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
    - 3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

### 1.5 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-Annex G for valve materials for potable-water service.

### 1.6 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.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

### PART 2 - PRODUCTS

# 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to 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 (DN 150) and smaller except plug valves.
  - 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-inch (50-mm) stem extensions and the following features:
  - 1. 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.
- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Solder Joint: With sockets according to ASME B16.18.
  - 3. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.
- H. Potable-water valves and components shall comply with NSF-14 and NSF-61.

# 2.2 BRONZE ANGLE VALVES

- A. Class 125, Bronze Angle Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, LTD.
    - d. Legend Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO, Inc.
    - g. Red-White Valve Corporation.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 1.
    - b. CWP Rating: 200 psig.
    - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    - d. Ends: Threaded.

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- e. Stem and Disc: Bronze.
- f. Packing: Asbestos free.
- g. Handwheel: Malleable iron.

### 2.3 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, LTD.
    - d. Legend Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO, Inc.
    - g. Red-White Valve Corporation.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig (1035 kPa).
    - c. CWP Rating: 600 psig (4140 kPa).
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded.
    - g. Seats: PTFE or TFE.
    - h. Stem: Bronze.
    - i. Ball: Chrome-plated brass.
    - j. Port: Full.

# 2.4 BRONZE LIFT CHECK VALVES

- A. Class 125, Lift Check Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, Inc.
    - d. Legend Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO, Inc.

- g. Red-White Valve Corporation.
- 2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 200 psig (1380 kPa).
  - c. Body Design: Vertical flow.
  - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
  - e. Ends: Threaded.
  - f. Disc: Bronze.
- B. Class 125, Lift Check Valves with Nonmetallic Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, LTD.
    - d. Legend Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO, Inc.
    - g. Red-White Valve Corporation.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 2.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Vertical flow.
    - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: NBR, PTFE, or TFE.

# 2.5 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, LTD.
    - d. Legend Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO, Inc.

- g. Red-White Valve Corporation.
- 2. Description:
  - a. Standard: MSS SP-80, Type 3.
  - b. CWP Rating: 200 psig (1380 kPa).
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B 62, bronze.
  - e. Ends: Threaded.
  - f. Disc: Bronze.
- B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, LTD.
    - d. Legend Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO, Inc.
    - g. Red-White Valve Corporation.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 4.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: PTFE or TFE.

# 2.6 IRON SWING CHECK VALVES

- A. Class 125, Iron Swing Check Valves with Metal Seats:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, LTD.
    - d. Legend Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO, Inc.

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- 2. Description:
  - a. Standard: MSS SP-71, Type I.
  - b. CWP Rating: 200 psig (1380 kPa).
  - c. Body Design: Clear or full waterway.
  - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - e. Ends: Flanged.
  - f. Trim: Bronze.
  - g. Gasket: Asbestos free.
- B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, LTD.
    - d. Legend Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO, Inc.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: Flanged.
    - f. Trim: Composition.
    - g. Seat Ring: Bronze.
    - h. Disc Holder: Bronze.
    - i. Disc: PTFE or TFE.
    - j. Gasket: Asbestos free.

### 2.7 BRONZE GATE VALVES

- A. Class 125, NRS Bronze Gate Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, LTD.
    - d. Legend Valve.

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- e. Milwaukee Valve Company.
- f. NIBCO, Inc.
- g. Red-White Valve Corporation.
- 2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 200 psig (1380 kPa).
  - 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 iron.
- B. Class 125, RS Bronze Gate Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, LTD.
    - d. Legend Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO, Inc.
    - g. Red-White Valve Corporation.
  - 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 iron.
### 2.8 BRONZE GLOBE VALVES

- A. Class 125, Bronze Globe Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, LTD.
    - d. Legend Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO, Inc.
    - g. Red-White Valve Corporation.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 1.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    - d. Ends: Threaded solder joint.
    - e. Stem and Disc: Bronze.
    - f. Packing: Asbestos free.
    - g. Handwheel: Malleable iron.
- B. Class 125, Bronze Globe Valves with Nonmetallic Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Jomar International, LTD.
    - d. Legend Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO, Inc.
    - g. Red-White Valve Corporation.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 2.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    - d. Ends: Threaded solder joint.
    - e. Stem: Bronze.
    - f. Disc: PTFE or TFE.
    - g. Packing: Asbestos free.

h. Handwheel: Malleable iron.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
  - 3. Lift Check Valves: With stem upright and plumb.

## 3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball, butterfly or gate valves.
  - 2. Throttling Service: Globe valves.
  - 3. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    - b. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
  - 4. Mixing valves check valves
    - a. Provide swing type check valve on piping upstream of mixing valves, with pipes in horizontal positions.
    - b. Provide Center-Guided check valves on piping upstream of mixing valves, with pipes in the vertical position.
  - 5. Mop Basin check valves
    - a. Provide swing type check valve on piping upstream of mixing valves, with pipes in horizontal positions.
    - b. Provide Center-Guided check valves on piping upstream of mixing valves, with pipes in the vertical position.
- 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 valveend 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.

### 3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 4 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, non-metallic disc.
- 4. Bronze Globe Valves: Class 125, bronze disc.

END OF SECTION 22 05 23

## 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. Fiberglass pipe hangers.
  - 4. Metal framing systems.
  - 5. Fiberglass strut systems.
  - 6. Thermal-hanger shield inserts.
  - 7. Fastener systems.
  - 8. Pipe stands.
  - 9. Pipe positioning systems.
  - 10. Equipment supports.
- B. Related Sections:
  - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 2. Division 21 fire-suppression piping Sections for pipe hangers for fire-suppression piping.
  - 3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
  - 4. 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 and obtain approval from authorities having jurisdiction.

# 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Fiberglass strut systems.
  - 4. Pipe stands.
  - 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

# 1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

## 1.7 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. Stainless-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe 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 stainless 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, provide products by one of 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. Value Engineered Products, Inc.
- 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 inches 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.
  - 1. Perforated straps are not acceptable.
- 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-Mounting-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 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: Non-staining, 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 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe 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.
- F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections 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. 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.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution 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 weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
- 4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - b. NPS 4: 12 inches long and 0.06 inch thick.
  - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
  - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
  - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
- 6. Thermal-Hanger Shields: Install with insulation 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 1-1/2 inches.

## 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,
- 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 stainless-steel pipe hangers or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper] attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.

- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow offcenter 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 non-insulated, nonstationary pipes NPS 1/2 to NPS 8.
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
  - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of nonstationary 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 steelpipe 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 steelpipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with Ubolt 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.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
  - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  - 6. C-Clamps (MSS Type 23): For structural shapes.
  - 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  - 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  - 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel Ibeams for heavy loads.
  - 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams for heavy loads, with link extensions.

- 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
  - a. Light (MSS Type 31): 750 lb.
  - b. Medium (MSS Type 32): 1500 lb.
  - c. Heavy (MSS Type 33): 3000 lb.
- 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  - 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  - 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  - 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  - 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  - 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  - 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

- 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
  - a. Horizontal (MSS Type 54): Mounted horizontally.
  - b. Vertical (MSS Type 55): Mounted vertically.
  - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

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 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

### 1.4 COORDINATION

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

PART 2 - PRODUCTS

### 2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick and having predrilled holes for attachment hardware.
  - 2. Letter Color: Black.
  - 3. Background Color: White.
  - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 7. Fasteners: Stainless-steel 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 8-1/2-by-11-inch 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, 1/16 inch thick and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel 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 partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

### 2.4 VALVE TAGS

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

### 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: 3 by 5-1/4 inches, approximately 4 by 7 inches.
  - 2. Fasteners: Brass grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  - 4. Color: 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.
- 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 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

- C. Pipe Label:
  - 1. Pipe label color shall be industry standard, ANSE/ASME for all pipe systems.

### 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. All piped systems: 1-1/2 inches.
  - 2. Valve-Tag Color:
    - a. All piped systems: Natural.
  - 3. Letter Color:
    - a. All piped systems: 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. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
  - 1. Division 22 Section "Plumbing Equipment Insulation."

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

### 1.5 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.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

## 1.6 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.

# 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "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.

### 1.8 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. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. 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. Block Insulation: ASTM C 552, Type I.
  - 2. Special-Shaped Insulation: ASTM C 552, Type III.
  - 3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 4. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
  - 5. Factory fabricated shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
- H. Mineral-Fiber: Preformed pipe insulation of glass fibers bonded with thermosetting resin. Comply with ASTM C547.
  - 1. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
  - 2. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
  - 3. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### 2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg 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, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aeroseal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    - d. K-Flex USA; R-373 Contact Adhesive.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

# 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: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

### 2.4 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 370 White PVC tape.
    - b. Compac Corporation; 130.
    - c. Venture Tape; 1506 CW NS.
  - 2. Width: 2 inches.
  - 3. Thickness: 6 mils.
  - 4. Adhesion: 64 ounces force/inch in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch in width.

### 2.5 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. McGuire Manufacturing.
    - b. Truebro; a brand of IPS Corporation.
    - c. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

- 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and coldwater supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective insulation shields
  - 1. Description: metal shield formed to a 180 degree arc, designed to protect pipe insulation from damage and crushing at hanger locations. saddles shall be constructed from 20 gauge steel.

### 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.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that applies to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install all insulation, continuous through all pipe hangers, provide metal saddle shields to protect from insulation compression at pipe hangers.
- B. 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.
- C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- D. 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.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- H. Keep insulation materials dry during application and finishing.
- I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- J. Install insulation with least number of joints practical.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.5 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, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions.

Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

- 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
  - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  - 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  - 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

# 3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
  - 4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by

insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

- B. Insulation Installation on Pipe Flanges:
  - 1. Install preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
  - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  - 2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of cellular-glass insulation to valve body.
  - 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.

# 3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturers' recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  - 4. Secure insulation to flanges and seal seams with manufacturers' recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install mitered sections of pipe insulation.
  - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.
  - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

## 3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
  - 1. Draw jacket material smooth and tight.
  - 2. Install lap or joint strips with same material as jacket.
  - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
  - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
  - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturers' recommended adhesive.
  - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
### 3.9 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.
- 3.10 FIELD QUALITY CONTROL
  - A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
  - B. Perform tests and inspections.
  - C. Tests and Inspections:
    - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
  - D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. NPS 1 and Smaller: Insulation shall be one of the following:
    - a. Cellular Glass: 3/4 inches thick.
    - b. Flexible Elastomeric: 3/4 inch thick.
  - 2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
    - a. Cellular Glass: 3/4 inches thick.
    - b. Flexible Elastomeric: 3/4" inches thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
    - a. Cellular Glass: 1 inch thick.
    - b. Flexible Elastomeric: 1 inch thick.
  - 2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Flexible Elastomeric: 1-1/2 inch thick.
- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 3/4 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 3/4 inch 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, and fittings inside buildings.
  - 2. Encasement for piping.

#### 1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

### 1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

### PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

## 2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

#### DOMESTIC WATER PIPING

- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal seating surfaces.
  - 4. Solder-joint or threaded ends.
- G. Copper Pressure-Seal-Joint Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Elkhart Products Corporation.
    - b. NIBCO Inc.
    - c. Viega.
  - 2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
  - 3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

# 2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
  - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, non-metallic and asbestos free unless otherwise indicated.
  - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for generalduty brazing unless otherwise indicated.

- F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- 2.4 ENCASEMENT FOR PIPING
  - A. Standard: ASTM A 674 or AWWA C105/A21.5.
  - B. Form: Sheet.
  - C. Color: Blue.

### 2.5 TRANSITION FITTINGS

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  - 1. Description:
    - a. One end with threaded brass insert and one solvent-cement-socket end.

### 2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jomar International.
    - b. Watts; a division of Watts Water Technologies, Inc.
    - c. Wilkins; a Zurn company.
  - 2. Standard: ASSE 1079.
  - 3. Pressure Rating: 125 psig minimum at 180 deg F.
  - 4. End Connections: Solder-joint copper alloy and threaded ferrous.

- C. Dielectric Nipples:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Elster Perfection Corporation.
    - b. Grinnell Mechanical Products; Tyco Fire Products LP.
    - c. Matco-Norca.
    - d. Precision Plumbing Products, Inc.
    - e. Victaulic Company.
  - 2. Standard: IAPMO PS 66.
  - 3. Electroplated steel nipple complying with ASTM F 1545.
  - 4. Pressure Rating and Temperature: 300 psig at 225 deg F.
  - 5. End Connections: Male threaded or grooved.
  - 6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

- 3.1 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 underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
  - D. Install reduced pressure backflow preventers at an elevation of NO greater than 4'-0" above finished floor to the center line of the backflow preventer.
  - 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 for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Division 22 Section "Domestic Water Piping Specialties."
  - F. Install shutoff valve immediately upstream of each dielectric fitting.
  - G. Install domestic water piping level without pitch and plumb.

- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. 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.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping."
- R. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Division 22 Section "Meters and Gages for Plumbing Piping."
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

#### 3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  - 1. Press fittings: DO NOT USE ABRASIVE CLEANING METHODS.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. 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.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plasticto-metal transition fittings or unions.

# 3.4 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.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 6. NPS 6: 10 feet with 5/8-inch rod.
  - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code. Comply with requirements for connection sizes in Division 22 plumbing fixture Sections.
  - 3. 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 (DN 65) and larger.

# 3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

### 3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- 2. Piping Tests:
  - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
  - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
  - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.9 ADJUSTING

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.10 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 (50 mg/L) 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 (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Repeat procedures if biological examination shows contamination.
    - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of watersample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 shall be one of the following:
  - 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) joints.

- E. Above Ground Domestic Water Piping, NPS 2 and smaller shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) cast or wrought copper, solder-joint fittings.
  - 2. Hard copper tube, ASTM B88, Type L (ASTM B 88M, Type B) cast or wrought copper, brazed joint fittings.
- F. Above Ground Domestic Water Piping, NPS 2-1/2" and larger shall be the following:
  - 1. Hard Copper tube, ASTM B88, Type L (ASTM B 88M, Type B) cast or wrought copper, brazed joint fittings.

# 3.12 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 valves for piping NPS 2 and smaller. Use ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
  - 2. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16

# SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Vacuum breakers.
  - 2. Backflow preventers.
  - 3. Water pressure-reducing valves.
  - 4. Balancing valves.
  - 5. Temperature-actuated, water mixing valves.
  - 6. Strainers for domestic water piping.
  - 7. Outlet box.
  - 8. Hose bibbs.
  - 9. Wall hydrants.
  - 10. Post hydrants.
  - 11. Roof hydrants.
  - 12. Drain valves.
  - 13. Water-hammer arresters.
  - 14. Trap-seal primer device.
  - 15. Trap-seal primer systems.
  - 16. Flexible connectors.
  - 17. Water meters.
- B. Related Requirements:
  - 1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for fire water-service backflow prevention devices.
  - 2. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
  - 3. Section 221116 "Domestic Water Piping" for water meters.

### 1.3 DEFINITIONS

A. AMI: Advanced Metering Infrastructure.

- B. AMR: Automatic Meter Reading.
- C. FKM: A family of fluroelastomer materials defined by ASTM D1418.
- 1.4 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Shop Drawings: For domestic water piping specialties.
    - 1. Include diagrams for power, signal, and control wiring.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Test and inspection reports.
- B. Field quality-control reports.

### 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

### 1.7 DOMESTIC WATER SYSTEM SPECIALTIES

A. All specialties provided in the domestic water system shall be NSF G1 compliance for low lead.

### PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

### 2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: **125 psig<Insert value>** unless otherwise indicated.

## 2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers :
  - 1. Standard: ASSE 1001.
  - 2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
  - 3. Body: Bronze.
  - 4. Inlet and Outlet Connections: Threaded.
- B. Hose-Connection Vacuum Breakers:
  - 1. Standard: ASSE 1011.
  - 2. Body: Bronze, nonremovable, with manual drain.
  - 3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
- C. Pressure Vacuum Breakers:
  - 1. Standard: ASSE 1020.
  - 2. Operation: Continuous-pressure applications.
  - 3. Pressure Loss: 5 psig maximum, through middle third of flow range.
  - 4. Accessories:
    - a. Valves: Ball type, on inlet and outlet.

## 2.4 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers:
  - 1. Standard: ASSE 1013.
  - 2. Operation: Continuous-pressure applications.
  - 3. Pressure Loss: 12 psig maximum, through middle third of flow range.
  - 4. Pressure Loss at Design Flow Rate: 15 (maximum).
  - 5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
  - 6. Accessories:
    - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- B. Double-Check, Backflow-Prevention Assemblies:
  - 1. Standard: ASSE 1015.
  - 2. Operation: Continuous-pressure applications unless otherwise indicated.
  - 3. Pressure Loss: 5 psig maximum, through middle third of flow range.
  - 4. Pressure Loss at Design Flow Rate: 8 psig (maximum).

- 5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
- 6. Accessories:
  - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
  - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
- C. Hose-Connection Backflow Preventers :
  - 1. Standard: ASSE 1052.
  - 2. Operation: Up to 10-foot head of water back pressure.
  - 3. Inlet Size: NPS 3/4.
  - 4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
  - 5. Capacity: At least 3-gpm flow.

# 2.5 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators :
  - 1. Standard: ASSE 1003.
  - 2. Pressure Rating: Initial working pressure of 150 psig.
  - 3. Body: Bronze[ with chrome-plated finish] for NPS 2 and smaller; [bronze] [cast iron with interior lining that complies with AWWA C550 or that is FDA approved] for NPS 2-1/2 and NPS 3.
  - 4. End Connections: Threaded or solder for NPS 2 and smaller; flanged or solder for NPS 2-1/2 and NPS 3.

### 2.6 BALANCING VALVES

- A. Copper-Alloy Calibrated Balancing Valves :
  - 1. Type: Ball valve with two readout ports and memory-setting indicator.
  - 2. Body: Brass or bronze.
  - 3. Size: Same as connected piping, but not larger than NPS 2.
  - 4. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
- B. Memory-Stop Balancing Valves :
  - 1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
  - 2. Pressure Rating: 400-psig minimum CWP.
  - 3. Size: NPS 2 or smaller.
  - 4. Body: Copper alloy.
  - 5. Port: Standard or full port.
  - 6. Ball: Chrome-plated brass or stainless steel.
  - 7. Seats and Seals: Replaceable.

- 8. End Connections: Solder joint or threaded.
- 9. Handle: Vinyl-covered steel with memory-setting device.
- C. Automatic Flow Control Balancing Valves:
  - 1. Flow Regulation: Plus or minus 5 percent over 95 percent of the working range.
  - 2. Pressure Rating: 200 psig.
  - 3. Size: NPS 2 or smaller.
  - 4. Body: Stainless steel or brass.
  - 5. Flow Cartridge: Stainless steel or antiscale polymer.
  - 6. End Connections: Threaded or solder joint.

# 2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Water-Temperature Limiting Devices :
  - 1. Standard: ASSE 1070.
  - 2. Pressure Rating: 125 psig.
  - 3. Type: Thermostatically controlled, water mixing valve.
  - 4. Material: Bronze body with corrosion-resistant interior components.
  - 5. Connections: Threaded[ **union**] inlets and outlet.
  - 6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
- B. Primary, Thermostatic, Water Mixing Valves:
  - 1. Standard: ASSE 1017.
  - 2. Pressure Rating: 125 psig minimum unless otherwise indicated.
  - 3. Type: Eposed-mounted , thermostatically controlled, water mixing valve.
  - 4. Material: Bronze body with corrosion-resistant interior components.
  - 5. Connections: Threaded[ union] inlets and outlet.
  - 6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
  - 7. Cabinet: Factory fabricated, stainless steel, for recessed or surface mounting and with hinged, stainless steel door.
- C. Individual-Fixture, Water Tempering Valves:
  - 1. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
  - 2. Pressure Rating: 125 psig minimum unless otherwise indicated.
  - 3. Material: Bronze body with corrosion-resistant interior components.
  - 4. Temperature Control: Adjustable.
  - 5. Connections: Threaded inlets and outlet.
  - 6. Finish: Chrome plated.
  - 7. Tempered-Water Setting: 110 deg. F.
  - 8. Tempered-Water Design Flow Rate:1.5 gpm.

- 9. Internal check valves.
- 10. Internal mesh screens.
- D. Primary Water Tempering Valves:
  - 1. Standard: ASSE 1017, thermostatically controlled, water tempering valve, listed as tempering valve.
  - 2. Pressure Rating: 125 psig minimum unless otherwise indicated.
  - 3. Material: Bronze body.
  - 4. Temperature Control: Manual.
  - 5. Connections: Threaded inlets and outlet.
  - 6. Thermometer on inlets and outlet.

### 2.8 OUTLET BOXES

- A. Icemaker Outlet Boxes:
  - 1. Mounting: Recessed. Fire rated.
  - 2. Material and Finish: Enameled-steel, epoxy-painted-steel, or plastic box and faceplate.
  - 3. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
  - 4. Accessory: Water hammer arrestor.
  - 5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

### 2.9 HOSE BIBBS

- A. Hose Bibbs :
  - 1. Standard: ASME A112.18.1 for sediment faucets.
  - 2. Body Material: Bronze.
  - 3. Seat: Bronze, replaceable.
  - 4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
  - 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
  - 6. Pressure Rating: 125 psig.
  - 7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
  - 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
  - 9. Finish for Service Areas: Chrome or nickel plated.
  - 10. Finish for Finished Rooms: Chrome or nickel plated.
  - 11. Operation for Equipment Rooms: Wheel handle or operating key.
  - 12. Operation for Service Areas: Operating key.
  - 13. Operation for Finished Rooms: Wheel handle.
  - 14. Include operating key with each operating-key hose bibb.
  - 15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.10 WALL HYDRANTS

- A. Non-freeze Vacuum Breaker Wall Hydrants :
  - 1. Standard: ASSE 1019, Type A or Type B.
  - 2. Type: Automatic draining with integral air-inlet valve.
  - 3. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
  - 4. Pressure Rating: 125 psig.
  - 5. Operation: Loose key .
  - 6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
  - 7. Inlet: NPS 1/2.
  - 8. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

# 2.11 POST HYDRANTS

- A. Non-freeze, Draining-Type Post Hydrants :
  - 1. Standard: ASME A112.21.3M.
  - 2. Type: Non-freeze, exposed-outlet post hydrant.
  - 3. Operation: Loose key.
  - 4. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
  - 5. Casing: Bronze with casing guard.
  - 6. Inlet: NPS 3/4.
  - 7. Outlet: Garden-hose thread complying with ASME B1.20.7.
  - 8. Drain: Designed with hole to drain into ground when shut off.
  - 9. Vacuum Breaker:
    - a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    - b. Garden-hose thread complying with ASME B1.20.7 on outlet.
  - 10. Operating Key(s): **One** with each loose-key-operation wall hydrant.

### 2.12 ROOF HYDRANTS

- A. Non-freeze, Draining-Type Roof Hydrants:
  - 1. Standard: ASME A112.21.3M.
  - 2. Type: Non-freeze, exposed-outlet roof hydrant with coated cast-iron head and lift handle with lock option. Provide with deck flange and under deck clamp.
  - 3. Casing and Operating Rod: Bronze interior parts, galvanized-steel casing, and bronze valve housing designed with hole to drain.
  - 4. Inlet: NPS 3/4 .

- 5. Outlet: Garden-hose thread complying with ASME B1.20.7.
- 6. Vacuum Breaker:
  - a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
  - b. Garden-hose thread complying with ASME B1.20.7 on outlet.
  - c. Pipe drain fitting to nearest floor drain or mop basin, not within public or private finished spaces.

# 2.13 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves :
  - 1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
  - 2. Pressure Rating: 400-psig minimum CWP.
  - 3. Size: NPS 3/4.
  - 4. Body: Bronze.
  - 5. Ball: Chrome-plated brass.
  - 6. Seats and Seals: Replaceable.
  - 7. Handle: Vinyl-covered steel.
  - 8. Inlet: Threaded or solder joint.
  - 9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### 2.14 WATER-HAMMER ARRESTERS

- A. Water-Hammer Arresters:
  - 1. Standard: ASSE 1010 or PDI-WH 201.
  - 2. Type: Metal bellows or Piston.
  - 3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

### 2.15 TRAP-SEAL PRIMER DEVICE

- A. Supply-Type, Trap-Seal Primer Device :
  - 1. Standard: ASSE 1018.
  - 2. Pressure Rating: 125 psig minimum.
  - 3. Body: Bronze.
  - 4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
  - 5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
  - 6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

- B. Drainage-Type, Trap-Seal Primer Device :
  - 1. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
  - 2. Size: NPS 1-1/4 minimum.
  - 3. Material: Chrome-plated, cast brass.
- 2.16 TRAP-SEAL PRIMER SYSTEMS
  - A. Trap-Seal Primer Systems :
    - 1. Standard: ASSE 1044.
    - 2. Inlet Size: NPS 3/4, ASTM B88, Type L; copper, water tubing.
    - 3. Cabinet: Recessed-mounted steel box with stainless steel cover.
    - 4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120 V ac power.
      - 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.
    - 5. Vacuum Breaker: ASSE 1001.

### 2.17 FLEXIBLE CONNECTORS

- A. 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.

### 2.18 WATER METERS

A. Provided by Utility Company.

### PART 3 - EXECUTION

- 3.1 INSTALLATION OF PIPING SPECIALTIES
  - A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
    - 1. Locate backflow preventers in same room as connected equipment or system.

- 2. Install drain for backflow preventers with atmospheric-vent drain connection with airgap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
- 3. Do not install bypass piping around backflow preventers.
- B. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.
- C. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.
- D. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
  - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Y-Pattern Strainers: For water, install on supply side of each control valve, water pressurereducing valve, solenoid valve and pump.
- F. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 1-1/2-by-3-1/2inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
- G. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.
  - Install cabinet-type units recessed in or surface mounted on wall as specified. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
- H. Nonfreeze, Draining-Type Post Hydrants: Install with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.
- I. Nonfreeze, Draining-Type Roof Hydrants: Install with drain connection piped to nearest floor drain or to the exterior.
- J. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
- K. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- L. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

M. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

### 3.2 PIPING CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

### 3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

# 3.4 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

## 3.5 IDENTIFICATION

- A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Vacuum breakers.
  - 2. Backflow preventers.
  - 3. Water pressure-reducing valves.
  - 4. Balancing valves.
  - 5. Temperature-actuated, water mixing valves.
  - 6. Outlet boxes.
  - 7. Wall hydrants.
  - 8. Post hydrants.
  - 9. Roof hydrants.
  - 10. Trap-seal primer device.
  - 11. Trap-seal primer systems.

- 12. Water meters.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

# 3.6 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.
- D. Adjust each pressure vacuum breaker, reduced-pressure-principle backflow preventer, doublecheck, in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
  - 1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, according to authorities having jurisdiction and the device's reference standard.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

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E. Prepare test and inspection reports.

END OF SECTION 22 11 19

# SECTION 22 11 20 - DOMESTIC WATER PUMPS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Horizontally mounted, in-line, close-coupled centrifugal pumps.
  - 2. Vertically mounted, in-line, close-coupled centrifugal pumps.
- B. Related Sections include the following:
  - 1. Division 22 Section "Domestic-Water Packaged Booster Pumps" for booster systems.

### 1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

# 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

# 1.6 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- 1.7 DELIVERY, STORAGE, AND HANDLING
  - A. Retain shipping flange protective covers and protective coatings during storage.
  - B. Protect bearings and couplings against damage.
  - C. Comply with pump manufacturer's written rigging instructions for handling.

### 1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

### PART 2 - PRODUCTS

### 2.1 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Armstrong Pumps Inc.
  - 2. Bell & Gossett Domestic Pump; ITT Corporation.
  - 3. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
  - 4. Pentair Pump Group; Aurora Pump.
  - 5. TACO Incorporated.
- B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhungimpeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.
- C. Pump Construction:
  - 1. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
  - 2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
  - 3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
  - 4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
  - 5. Bearings: Oil-lubricated; bronze-journal or ball type.

- 6. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
- D. Motor: Single speed, with grease-lubricated ball bearings; and resiliently or rigidly mounted to pump casing.
- E. Capacities and Characteristics:
  - 1. REFER TO THE PLUMBING EQUIPMENT SCHEDULE

# 2.2 VERTICALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Armstrong Pumps Inc.
  - 2. Bell & Gossett Domestic Pump; ITT Corporation.
  - 3. Grundfos Pumps Corp.
  - 4. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
  - 5. Peerless Pump, Inc.
  - 6. Pentair Pump Group; Aurora Pump.
  - 7. TACO Incorporated.
- B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhungimpeller centrifugal pumps designed for installation with pump and motor shaft mounted vertical.
- C. Pump Construction:
  - 1. Casing: Radially split, cast iron, with wear rings and threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections. Include pump manufacturer's base attachment for mounting pump on concrete base.
  - 2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
  - 3. Shaft and Shaft Sleeve: Stainless-steel shaft, with copper-alloy shaft sleeve.
  - 4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
  - 5. Bearings: Oil-lubricated; bronze-journal or ball type.
  - 6. Shaft Coupling: Flexible or rigid type if pump is provided with coupling.
- D. Motor: Single speed, with grease-lubricated ball bearings; and rigidly mounted to pump casing.
- E. Capacities and Characteristics:
  - 1. REFER TO THE PLUMBING EQUIPMENT SCHEDULE

## 2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
  - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

# 2.4 CONTROLS

- A. Pressure Switches: Electric, adjustable for control of **water-supply** pump.
  - 1. Type: Water-immersion pressure sensor, for installation in piping.
  - 2. Enclosure: NEMA 250, Type 4X.
  - 3. Operation of Pump: On or off.
  - 4. Transformer: Provide if required.
  - 5. Power Requirement: 24 V, ac.
- B. Thermostats: Electric; adjustable for control of **hot-water circulation** pump.
  - 1. Type: Water-immersion temperature sensor, for installation in piping.
  - 2. Range: 50 to 125 deg F.
  - 3. Enclosure: NEMA 250, Type 4X.
  - 4. Operation of Pump: On or off.
  - 5. Transformer: Provide if required.
  - 6. Power Requirement: 24 V, ac.
  - 7. Settings: REFER TO DOMESTIC WATER HEATER DETAIL; Start pump at 105 deg F and stop pump at 110 deg F.
- C. Timers: Electric, for control of hot-water circulation pump.
  - 1. Type: Programmable, seven-day clock with manual override on-off switch.
  - 2. Enclosure: NEMA 250, Type 1], suitable for wall mounting.
  - 3. Operation of Pump: On or off.
  - 4. Transformer: Provide if required.
  - 5. Power Requirement: 24-V ac.
  - 6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.
- 3.2 PUMP INSTALLATION
  - A. Comply with HI 1.4.
  - B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.
  - C. Install horizontally mounted, in-line, close-coupled centrifugal pumps with shaft(s) horizontal.
  - D. Install vertically mounted, in-line, close-coupled centrifugal pumps with shaft vertical.
  - E. Pump Mounting: Install vertically mounted, in-line, close-coupled centrifugal pumps with castiron base mounted on concrete base using elastomeric pads OR elastomeric mounts OR restrained spring isolators. Comply with requirements for concrete base specified in Division 03.
    - 1. Minimum Deflection: 1/4 inch.
    - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
    - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
    - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - F. Install continuous-thread hanger rods and spring hangers of size required to support pump weight.
    - 1. Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
    - 2. Comply with requirements for hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
  - G. Install pressure switches in water supply piping.
  - H. Install thermostats in hot-water return piping.

- I. Install timers on wall adjacent to pump, in an accessible location from a standing position..
- J. Install time-delay relays in piping between water heaters and hot-water storage tanks.

### 3.3 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
  - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
    - a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
    - b. Vertically mounted, in-line, close-coupled centrifugal pumps.
    - c. Comply with requirements for flexible connectors specified in Division 22 Section "Domestic Water Piping."
  - 2. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Division 22 Section "Domestic Water Piping Specialties."
  - 3. Install pressure gage and snubber at suction of each pump and pressure gage and snubbe at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- D. Comply with Division 26 Sections for electrical connections and wiring methods.
- E. Connect pressure switches, thermostats, time-delay relays, and timers to pumps that they control.
- F. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

#### 3.4 IDENTIFICATION

A. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification of pumps.

## 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Check piping connections for tightness.
  - 3. Clean strainers on suction piping.
  - 4. Set pressure switches, thermostats, timers, and time-delay relays for automatic starting and stopping operation of pumps.
  - 5. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.
    - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    - c. Verify that pump is rotating in the correct direction.
  - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
  - 7. Start motor.
  - 8. Open discharge valve slowly.
  - 9. Adjust temperature settings on thermostats.
  - 10. Adjust timer settings.

### 3.6 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 22 11 20
## SECTION 22 13 16 - SANITARY WASTE AND VENT AND STORM 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.
  - B. Related Sections:
    - 1. Division 22 Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Storm, Soil, Waste, and Vent Piping: 10-foot head of water.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For sovent drainage system. Include plans, elevations, sections, and details.

# 1.5 INFORMATIONAL SUBMITTALS

- A. 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.
- B. Field quality-control reports.

## 1.6 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.

## 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 (MAY BE UTILIZED IN UNDERSLAB INSTALLATIONS OF SANITARY WASTE.
  - A. Pipe and Fittings: ASTM A 74, service and Extra Heavy classes.
  - B. Gaskets: ASTM C 564, rubber.
  - C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.
- 2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS (SHALL BE UTILIEZED IN ALL ABOVE CEILING INSTALLATIONS, DUE TO PLENUM RETURN HVAC SYSTEMS)
  - A. Pipe and Fittings: ASTM A 888 or CISPI 301.
  - B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

- C. CISPI, Hubless-Piping Couplings:
  - 1. Standards: ASTM C 1277 and CISPI 310.
  - 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- D. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Standards: ASTM C 1277 and ASTM C 1540.
  - 2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- E. Cast-Iron, Hubless-Piping Couplings:
  - 1. Standard: ASTM C 1277.
  - 2. 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 PVC PIPE AND FITTINGS (MAY ONLY BE UTILIZED IN NON-PLENUM INSTALLATIONS)
  - A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
  - B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
  - C. Adhesive Primer: ASTM F 656.
    - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
  - D. Solvent Cement: ASTM D 2564.
    - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
  - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
  - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  - 3. Unshielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1173.
    - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
  - 4. Shielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1460.
    - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Dielectric Fittings:
  - 1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
  - 2. Dielectric Unions:
    - a. Description:
      - 1) Standard: ASSE 1079.
      - 2) Pressure Rating: 125 psig minimum at 180 deg F.
      - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
  - 3. Dielectric Flanges:
    - a. Description:
      - 1) Standard: ASSE 1079.
      - 2) Factory-fabricated, bolted, companion-flange assembly.
      - 3) Pressure Rating: 125 psig minimum at 180 deg F.

- 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- 4. Dielectric-Flange Insulating Kits:
  - a. Description:
    - 1) Non-conducting materials for field assembly of companion flanges.
    - 2) Pressure Rating: 150 psig.
    - 3) Gasket: Neoprene or phenolic.
    - 4) Bolt Sleeves: Phenolic or polyethylene.
    - 5) Washers: Phenolic with steel backing washers.
- 5. Dielectric Nipples:
  - a. Description:
    - 1) Standard: IAPMO PS 66
    - 2) Electroplated steel nipple.
    - 3) Pressure Rating: 300 psig at 225 deg F.
    - 4) End Connections: Male threaded or grooved.
    - 5) Lining: Inert and noncorrosive, propylene.

# 2.6 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black or natural.

# 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. All piping located in ceiling plenums shall be metallic or cast iron pipe with no exception.

- B. All vertical piping, if concealed within a column wrap may be installed with PVC pipe and fittings or with metallic or cast iron pipe materials. If the column wrap is not continuous from floor structure to floor structure the entire pipe shall be metallic or cast iron product.
- C. Branch pipe from Storm, sanitary stack and vent stacks shall transition within the column enclosure to a metallic or cast iron product with the use of manufactures approved fittings within the column enclosure. The penetration through the column enclosure shall be fire stopped as required by the building construction type and associated requirements.
- D. 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.
- E. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- F. 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.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- H. Install piping to permit valve servicing.
- I. Install piping at indicated slopes.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install piping to allow application of insulation.
- M. Make changes in direction for storm, soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. 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.
- N. 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.

- O. Install storm, soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- P. 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.
- Q. Install steel piping according to applicable plumbing code.
- R. Install aboveground PVC piping according to ASTM D 2665.
- S. Install underground PVC piping according to ASTM D 2321.
- T. Install engineered soil and waste drainage and vent piping systems as follows:
  - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
  - 2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
  - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- U. 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."
  - 2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
- V. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "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 Division 22 Section "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 Division 22 Section "Escutcheons for Plumbing Piping."
- Z. All horizontal sanitary pipe shall be insulated.

# 3.3 JOINT CONSTRUCTION

- A. 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.
- B. 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.
- C. 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.
- D. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

# 3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in OD's.
  - 2. In Drainage Piping: Shielded, non-pressure transition couplings.
  - 3. In Aboveground Force Main Piping: Fitting-type transition couplings.
  - 4. In Underground Force Main Piping:
    - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    - b. NPS 2 and Larger: Pressure transition couplings.

- B. Dielectric Fittings:
  - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
  - 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
  - 3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
  - 4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

## 3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves:
  - 1. Install shutoff valve on each sewage pump discharge.
  - 2. Install gate or full-port ball valve for piping NPS 2 and smaller.
  - 3. Install gate valve for piping NPS 2-1/2 and larger.

## 3.6 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 Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 6. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- D. Support vertical piping and tubing at base and at each floor.

- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 1/2-inch rod.
  - 4. NPS 6 and NPS 8: 60 inches with 1/2-inch rod.
  - 5. NPS 10 and NPS 12: 60 inches with 1/2-inch rod.
  - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  - 2. NPS 3: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- I. Install supports for vertical ABS and PVC piping every 48 inches.
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm piping to exterior storm piping. Use transition fitting to join dissimilar piping materials.
- D. 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. 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.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- F. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

# 3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

# 3.9 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary 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-foot 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-inch 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.

# 3.10 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

# 3.11 PIPING SCHEDULE

- A. All piping located in ceiling plenums shall be metallic or cast iron pipe with no exception.
- B. All vertical piping, if concealed within a column wrap may be installed with PVC pipe and fittings or with metallic or cast iron pipe materials. If the column wrap is not continuous from floor structure to floor structure the entire pipe shall be metallic or cast iron product.
- C. Branch pipe from sanitary stack and vent stacks shall transition within the column enclosure to a metallic or cast iron product with the use of manufactures approved fittings within the column enclosure. The penetration through the column enclosure shall be fire stopped as required by the building construction type and associated requirements.
- D. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

- E. Aboveground, soil and waste piping NPS 3 and smaller shall be any of the following, as allowed by local code:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; CISPI (for buildings three stories and shorter) and heavy-duty (the lower floors below the top three floors of a building four stories or taller) hubless-piping couplings; and coupled joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
  - 4. All piping within the return air plenum shall meet the 25/50 flame/smoke rating and shall be metallic or cast iron pipe product rating and shall be metallic or cast iron pipe product.
- F. Aboveground, storm, soil and waste piping NPS 4 and larger shall be any of the following as allowed by local code:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; CISPI (for buildings three stories and shorter) and heavy-duty (the lower floors below the top three floors of a building four stories or taller) hubless-piping couplings; and coupled joints.
  - 3. All piping within the return air plenum shall meet the 25/50 flame/smoke rating and shall be metallic or cast iron pipe product rating and shall be metallic or cast iron pipe product.
  - 4. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
- G. Aboveground, vent piping NPS 4 and smaller shall be any of the following as allowed by local code:
  - 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. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
  - 4. All piping within the return air plenum shall meet the 25/50 flame/smoke rating and shall be metallic or cast iron pipe product rating and shall be metallic or cast iron pipe product.
- H. Aboveground, vent piping NPS 5 and larger shall be any of the following, as allowed by local code:
  - 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. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
  - 4. All piping within the return air plenum shall meet the 25/50 flame/smoke rating and shall be metallic or cast iron pipe product rating and shall be metallic or cast iron pipe product.

- I. Underground, storm, soil, waste, and vent piping NPS 4 and smaller shall be any of the following as allowed by local code:
  - 1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
  - 2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
- J. Underground, storm, soil and waste piping NPS 5 and larger shall be any of the following as allowed by local code:
  - 1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
  - 2. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

END OF SECTION 22 13 16

## SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Channel drainage.
  - 4. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
  - 1. Division 22 Section "Storm Drainage Piping Specialties" for storm drainage piping inside the building, drainage piping specialties, and drains.
  - 2. Division 22 Section "Plumbing Fixtures" for hair interceptors.
  - 3. Division 33 Section "Storm Utility Drainage Piping" for storm draining piping and piping specialties outside the building.

### 1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene plastic.
- D. PE: Polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.

### 1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1. Wiring Diagrams: Power, signal, and control wiring.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Seismic Qualification Certification: Submit certification that FOG disposal systems, grease interceptors, grease removal devices, oil interceptors, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control test reports.

### 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

### 1.7 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- 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 NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

### 1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof penetrations.

# PART 2 - PRODUCTS

## 2.1 CLEANOUTS

- A. Exposed Metal Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - d. Tyler Pipe; Wade Div.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
    - g. Josam Company; Blucher-Josam Div.
  - 2. Standard: ASME A112.36.2M for cast iron OR ASME A112.3.1 for stainless steel for cleanout test tee.
  - 3. Size: Same as connected drainage piping
  - 4. Body Material: Hub-less, cast-iron soil pipe test tee or Stainless-steel tee with side cleanout as required to match connected piping.
  - 5. Closure: Countersunk, cast-iron plug.
  - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
  - 7. Closure: Stainless-steel plug with seal.
- B. Metal Floor Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. Oatey.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - e. Tyler Pipe; Wade Div.
    - f. Watts Drainage Products Inc.
    - g. Zurn Plumbing Products Group; Specification Drainage Operation.

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- h. Josam Company; Josam Div.
- i. Josam Company; Blucher-Josam Div.
- 2. Standard: ASME A112.36.2M for adjustable housing cleanout.
- 3. Size: Same as connected branch.
- 4. Type: Adjustable housing.
- 5. Body or Ferrule: Cast iron or Stainless steel.
- 6. Clamping Device: Not required.
- 7. Outlet Connection: Inside calk.
- 8. Closure: Brass plug with straight threads and gasket.
- 9. Adjustable Housing Material: Cast iron with threads.
- 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy or Stainless steel.
- 11. Frame and Cover Shape: Round.
- 12. Top Loading Classification: Heavy duty.
- 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- 14. Standard: ASME A112.3.1.
- 15. Size: Same as connected branch.
- 16. Housing: Stainless steel.
- 17. Closure: Stainless steel with seal.
- 18. Riser: Stainless-steel drainage pipe fitting to cleanout.
- C. Cast-Iron Wall Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - d. Tyler Pipe; Wade Div.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.36.2M. Include wall access.
  - 3. Size: Same as connected drainage piping.
  - 4. Body: Hub-less, cast-iron soil pipe test tee as required to match connected piping.
  - 5. Closure: Countersunk cast-iron plug.
  - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
  - 7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

### 2.2 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - d. Tyler Pipe; Wade Div.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Top Loading Classification: Heavy Duty.
- B. Stainless-Steel Floor Drains:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Blucher-Josam Div.
    - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - c. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.3.1, ASME A112.6.3.

### 2.3 CHANNEL DRAINAGE SYSTEMS

- A. Wall Box:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Oatey.
  - 2. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.
  - 3. Size: About 9 inches wide by 8 inches high by 4 inches deep.

PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Assemble plastic channel drainage system components according to manufacturer's written
- F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- I. Install vent caps on each vent pipe passing through roof.

- J. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- K. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- L. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- M. Install wood-blocking reinforcement for wall-mounting-type specialties.
- N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

## 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

### SECTION 22 16 14 - NATURAL-GAS PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipes, tubes, and fittings.
  - 2. Piping specialties.
  - 3. Piping and tubing joining materials.
  - 4. Valves.
  - 5. Pressure regulators.
  - 6. Service meters.
  - 7. Concrete bases.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

### 1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
  - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
  - 2. Service Regulators: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 2 psig.

- C. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.
- D. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Piping specialties.
  - 2. Corrugated, stainless-steel tubing with associated components.
  - 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
  - 4. Pressure regulators. Indicate pressure ratings and capacities.
  - 5. Dielectric fittings.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
  - 1. Shop Drawing Scale: 1/4 inch per foot.
  - 2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.
- C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of seismic restraints.
  - 2. Design Calculations: Calculate requirements for selecting seismic restraints.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
- C. Qualification Data: For qualified professional engineer.

- D. Welding certificates.
- E. Field quality-control reports.

### 1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For motorized gas valves pressure regulators and to include in emergency, operation, and maintenance manuals.

### 1.8 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

### 1.10 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

## 1.11 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

### PART 2 - PRODUCTS

## 2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
  - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    - a. Material Group: 1.1.
    - b. End Connections: Threaded or butt welding to match pipe.
    - c. Lapped Face: Not permitted underground.
    - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
  - 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
    - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
  - 6. Mechanical Couplings:
    - a. Steel flanges and tube with epoxy finish.
    - b. Buna-nitrile seals.
    - c. Steel bolts, washers, and nuts.
    - d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    - e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

### 2.2 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
  - 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
  - 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
  - 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
  - 4. Corrugated stainless-steel tubing with polymer coating.
  - 5. Operating-Pressure Rating: 0.5 psig.
  - 6. End Fittings: Zinc-coated steel.
  - 7. Threaded Ends: Comply with ASME B1.20.1.
  - 8. Maximum Length: 72 inches.
- B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
  - 1. Copper-alloy convenience outlet and matching plug connector.
  - 2. Nitrile seals.
  - 3. Hand operated with automatic shutoff when disconnected.
  - 4. For indoor or outdoor applications.
  - 5. Adjustable, retractable restraining cable.
- C. Y-Pattern Strainers:
  - 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
  - 2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
  - 3. Strainer Screen: 40-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
  - 4. CWP Rating: 125 psig.
- D. Basket Strainers:
  - 1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
  - 2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
  - 3. Strainer Screen: 40-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
  - 4. CWP Rating: 125 psig.
- E. T-Pattern Strainers:
  - 1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
  - 2. End Connections: Grooved ends.
  - 3. Strainer Screen: 40-mesh startup strainer and perforated stainless-steel basket with 57 percent free area.

- 4. CWP Rating: 750 psig.
- F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

## 2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

## 2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
  - 1. CWP Rating: 125 psig.
  - 2. Threaded Ends: Comply with ASME B1.20.1.
  - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
  - 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
  - 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
  - 1. CWP Rating: 125 psig.
  - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
  - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

- D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
  - 1. Body: Bronze, complying with ASTM B 584.
  - 2. Ball: Chrome-plated brass.
  - 3. Stem: Bronze; blowout proof.
  - 4. Seats: Reinforced TFE; blowout proof.
  - 5. Packing: Separate packnut with adjustable-stem packing threaded ends.
  - 6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 7. CWP Rating: 600 psig.
  - 8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
  - 1. Body: Bronze, complying with ASTM B 584.
  - 2. Ball: Chrome-plated bronze.
  - 3. Stem: Bronze; blowout proof.
  - 4. Seats: Reinforced TFE; blowout proof.
  - 5. Packing: Threaded-body packnut design with adjustable-stem packing.
  - 6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 7. CWP Rating: 600 psig.
  - 8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
  - 1. Body: Bronze, complying with ASTM B 584.
  - 2. Ball: Chrome-plated bronze.
  - 3. Stem: Bronze; blowout proof.
  - 4. Seats: Reinforced TFE.
  - 5. Packing: Threaded-body packnut design with adjustable-stem packing.
  - 6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 7. CWP Rating: 600 psig (4140 kPa).
  - 8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- G. Bronze Plug Valves: MSS SP-78.
  - 1. Body: Bronze, complying with ASTM B 584.
  - 2. Plug: Bronze.

- 3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
- 4. Operator: Square head or lug type with tamperproof feature where indicated.
- 5. Pressure Class: 125 psig (862 kPa).
- 6. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
- 7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- H. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
  - 1. Body: Cast iron, complying with ASTM A 126, Class B.
  - 2. Plug: Bronze or nickel-plated cast iron.
  - 3. Seat: Coated with thermoplastic.
  - 4. Stem Seal: Compatible with natural gas.
  - 5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 6. Operator: Square head or lug type with tamperproof feature where indicated.
  - 7. Pressure Class: 125 psig (862 kPa).
  - 8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- I. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
  - 1. Body: Cast iron, complying with ASTM A 126, Class B.
  - 2. Plug: Bronze or nickel-plated cast iron.
  - 3. Seat: Coated with thermoplastic.
  - 4. Stem Seal: Compatible with natural gas.
  - 5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 6. Operator: Square head or lug type with tamperproof feature where indicated.
  - 7. Pressure Class: 125 psig (862 kPa).
  - 8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- J. Valve Boxes:
  - 1. Cast-iron, two-section box.
  - 2. Top section with cover with "GAS" lettering.
  - 3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
  - 4. Adjustable cast-iron extensions of length required for depth of bury.
  - 5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

### 2.5 PRESSURE REGULATORS

- A. General Requirements:
  - 1. Single stage and suitable for natural gas.
  - 2. Steel jacket and corrosion-resistant components.
  - 3. Elevation compensator.
  - 4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.
- B. Service Pressure Regulators: Comply with ANSI Z21.80.
  - 1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
  - 2. Springs: Zinc-plated steel; interchangeable.
  - 3. Diaphragm Plate: Zinc-plated steel.
  - 4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
  - 5. Orifice: Aluminum; interchangeable.
  - 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
  - 7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
  - 8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
  - 9. Overpressure Protection Device: Factory mounted on pressure regulator.
  - 10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
    - a. Vent to exterior of building per manufactures requirements.
  - 11. Maximum Inlet Pressure: 100 psig.
- C. Line Pressure Regulators: Comply with ANSI Z21.80.
  - 1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
  - 2. Springs: Zinc-plated steel; interchangeable.
  - 3. Diaphragm Plate: Zinc-plated steel.
  - 4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
  - 5. Orifice: Aluminum; interchangeable.
  - 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
  - 7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
  - 8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
  - 9. Overpressure Protection Device: Factory mounted on pressure regulator.

- 10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
  - a. Vent to exterior of building per manufactures requirements
- 11. Maximum Inlet Pressure: 10 psig.

### 2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 125 psig minimum at 180 deg F.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. Factory-fabricated, bolted, companion-flange assembly.
    - c. Pressure Rating: 125 psig minimum at 180 deg F.
    - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
  - 1. Description:
    - a. Nonconducting materials for field assembly of companion flanges.
    - b. Pressure Rating: 150 psig.
    - c. Gasket: Neoprene or phenolic.
    - d. Bolt Sleeves: Phenolic or polyethylene.
    - e. Washers: Phenolic with steel backing washers.

## 2.7 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick,

continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54, the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54, the International Fuel Gas Code requirements for prevention of accidental ignition.

### 3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54, the International Fuel Gas Code for installation and purging of naturalgas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
  - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
  - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
  - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
  - 3. Replace pipe having damaged PE coating with new pipe.

- E. Copper Tubing with Protective Coating:
  - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
  - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

### 3.4 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54, the International Fuel Gas Code for installation and purging of naturalgas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
  - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
  - 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
  - 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
  - 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
    - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
  - 5. Prohibited Locations:
    - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    - b. Do not install natural-gas piping in solid walls or partitions.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.

- S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- V. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."
- W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

#### 3.5 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.
- 3.6 PIPING JOINT CONSTRUCTION
  - A. Ream ends of pipes and tubes and remove burrs.
  - B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  - C. Threaded Joints:
    - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
    - 2. Cut threads full and clean using sharp dies.

#### NATURAL-GAS PIPING
- 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
- 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
- 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
  - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  - 2. Bevel plain ends of steel pipe.
  - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

## 3.7 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- B. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.

- 5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.
- D. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
  - 2. NPS 1/2 and NPS 5/8: Maximum span, 72 inches; minimum rod size, 3/8 inch.
  - 3. NPS 3/4 and NPS 7/8: Maximum span, 84 inches; minimum rod size, 3/8 inch.
  - 4. NPS 1: Maximum span, 96 inches; minimum rod size, 3/8 inch.

## 3.8 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

## 3.9 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

## 3.10 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
  - 1. Alkyd System: MPI EXT 5.1D.

- a. Prime Coat: Alkyd anticorrosive metal primer.
- b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
- c. Topcoat: Exterior alkyd enamel flat.
- d. Color: Gray.
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
  - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Interior latex matching topcoat.
    - c. Topcoat: Interior latex flat.
    - d. Color: Gray.
  - 2. Alkyd System: MPI INT 5.1E.
    - a. Prime Coat: Quick-drying alkyd metal primer.
    - b. Intermediate Coat: Interior alkyd matching topcoat.
    - c. Topcoat: Interior alkyd flat.
    - d. Color: Gray.
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

## 3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Test, inspect, and purge natural gas according to NFPA 54, the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

# 3.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

# 3.13 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be one of the following:
  - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
  - 2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.
  - 3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
- C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

## 3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.
  - 3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
- C. Underground, below building, piping shall be one of the following:
  - 1. Steel pipe with wrought-steel fittings and welded joints.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

- 3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG
  - A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:
    - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - B. Aboveground, distribution piping shall be one of the following:
    - 1. Steel pipe with steel welding fittings and welded joints.
    - 2. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
  - C. Underground, below building, piping shall be one of the following:
    - 1. Steel pipe with wrought-steel fittings and welded joints.
  - D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
  - E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- 3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG
  - A. Aboveground Piping: Maximum operating pressure more than 5 psig.
  - B. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.
  - C. Aboveground, distribution piping shall be one of the following:
    - 1. Steel pipe with steel welding fittings and welded joints.
    - 2. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
  - D. Underground, below building, piping shall be the following:
    - 1. Steel pipe with wrought-steel fittings and welded joints.
  - E. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
  - F. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

## 3.17 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:
  - 1. One-piece, bronze ball valve with bronze trim.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.
  - 3. Cast-iron, nonlubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
  - 1. One-piece, bronze ball valve with bronze trim.
  - 2. Two-piece, full-port, bronze ball valves with bronze trim.
  - 3. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.
  - 3. Cast-iron, nonlubricated or lubricated plug valve.
- E. Valves in branch piping for single appliance shall be one of the following:
  - 1. One-piece, bronze ball valve with bronze trim.
  - 2. Two-piece, full-port, bronze ball valves with bronze trim.
  - 3. Bronze plug valve.

END OF SECTION 22 16 14

# SECTION 22 31 00 - DOMESTIC WATER SOFTENERS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Commercial water softeners.
  - 2. Chemicals.
  - 3. Water-testing sets.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Water softeners shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water softeners.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 3. Wiring Diagrams: For power, signal, and control wiring.

# 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For water softeners, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Source quality-control reports.
- C. Field quality-control reports.
- D. Warranty: Sample of special warranty.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water softeners to include in emergency, operation, and maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Salt for Brine Tanks: Furnish in same form as and at least not less than 400 lb. Deliver on pallets according to the following:
    - a. Plain Pellet Salt: In 40- or 50-lb packages.
  - 2. Store salt on raised platform where directed by Owner. Do not store in contact with concrete floor.

## 1.8 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 application.
- B. ASME Compliance for Steel Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, where indicated.

- C. ASME Compliance for FRP Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, where indicated.
- D. UL Compliance: Fabricate and label water softeners to comply with UL 979, "Water Treatment Appliances."

# 1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softeners that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures of mineral and brine tanks.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
    - d. Attrition loss of resin exceeding 3 percent per year.
    - e. Mineral washed out of system during service run or backwashing period.
    - f. Effluent turbidity greater and color darker than incoming water.
    - g. Fouling of underdrain system, gravel, and resin with turbidity or by dirt, rust, or scale from water softener or soft water, while operating according to manufacturer's written operating instructions.
  - 2. Commercial Water Softeners, Warranty Period: From date of Substantial Completion.
    - a. Mineral Tanks: Five years.
    - b. Brine Tanks: 10years.
    - c. Control Valve: two years.

## 1.11 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of water softener Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper water softener operation at rated capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
- B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is

concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

# PART 2 - PRODUCTS

# 2.1 COMMERCIAL WATER SOFTENERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Marlo Incorporated.
  - 2. Aqua Systems.
- B. Description: Factory-assembled, pressure-type water softener.
  - 1. Standard: Comply with NSF 61, "Drinking Water System Components Health Effects."
  - 2. Configuration: Twin unit with two mineral tanks and one brine tank.
  - 3. Mounting: On skids.
  - 4. Wetted Components: Suitable for water temperatures from 40 to at least 100 deg F.
  - 5. Mineral Tanks: FRP, pressure-vessel quality.
    - a. Construction: Non-ASME code. Fabricated to comply with ASME Boiler and Pressure Vessel Code: Section X, "Fiber-Reinforced Plastic Pressure Vessels."
    - b. Pressure Rating: 100 psig minimum.
    - c. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
    - d. Support Legs or Skirt: Constructed of structural steel, welded to tank before testing and labeling.
    - e. Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.
    - f. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from nonmetallic pipe and fittings with individual, fine-slotted, nonclogging plastic strainers, and arranged for even flow distribution through resin bed.
    - g. Liner: PE, ABS, or other material suitable for potable water.
  - 6. Controls: Automatic; factory wired and factory mounted on unit.
    - a. Adjustable duration of various regeneration steps.
    - b. Push-button start and complete manual operation.
    - c. Electric time clock and switch for automatic operation except for manual return to service.
    - d. Sequence of Operation: Multiport pilot-control valve automatically pressureactuates main operating valve through steps of regeneration.
    - e. Pointer on pilot-control valve shall indicate cycle of operation.
    - f. Includes means of manual operation of pilot-control valve if power fails.

- 7. Controls: Fully automatic; factory wired and factory mounted on unit.
  - a. Adjustable duration of various regeneration steps.
  - b. Push-button start and complete manual operation.
  - c. Electric time clock and switch for fully automatic operation, adjustable to initiate regeneration at any hour of day and any day of week or at fixed intervals.
  - d. Sequence of Operation: Multiport pilot-control valve automatically pressureactuates main operating valve through steps of regeneration and return to service.
  - e. Pointer on pilot-control valve shall indicate cycle of operation.
  - f. Includes means of manual operation of pilot-control valve if power fails.
- 8. Main Operating Valves: Industrial, automatic, multiport, diaphragm type with the following features:
  - a. Slow opening and closing, nonslam operation.
  - b. Diaphragm guiding on full perimeter from fully open to fully closed.
  - c. Isolated, dissimilar metals within valve.
  - d. Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.
  - e. Valve for single mineral-tank unit with internal automatic bypass of raw water during regeneration.
  - f. Sampling cocks for soft water.
  - g. Special tools are not required for service.
- 9. Flow Control: Automatic, to control backwash and flush rates over wide variations in operating pressure; does not require field adjustments.
  - a. Demand-Initiated Control: Each mineral tank of twin mineral-tank unit is equipped with automatic-reset-head water meter that electrically activates cycle controllers to initiate regeneration at preset total in gallons. Head automatically resets to preset total in gallons for next service run. Electrical lockout prevents simultaneous regeneration of both tanks.
- 10. Brine Tank: Combination measuring and wet-salt storing system.
  - a. Tank and Cover Material: Fiberglass, 3/16 inch thick; or molded PE, 3/8 inch thick.
  - b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawal and freshwater refill.
  - c. Size: Large enough for at least four regenerations at full salting.
- 11. Factory-Installed Accessories:
  - a. Piping, valves, tubing, and drains.
  - b. Sampling cocks.

- c. Main-operating-valve position indicators.
- d. Water meters.
- C. Capacities and Characteristics:
  - 1. Contractor shall conduct a water quality test and report the water hardness of the project site.
    - a. Refer to the PLUMBING EQUIPMENT SCHDULE

# 2.2 CHEMICALS

- A. Mineral: High-capacity, sulfonated-polystyrene, ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock.
  - 1. Exchange Capacity: 30,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 15 lb of salt.
- B. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are unacceptable.
  - 1. Form: Processed, plain salt pellets.

## 2.3 WATER-TESTING SETS

A. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

## 2.4 SOURCE QUALITY CONTROL

- A. Hydrostatically test mineral tanks before shipment to a minimum of one and one-half times the pressure rating.
- B. Prepare test and inspection reports.

# PART 3 - EXECUTION

- 3.1 WATER SOFTENER INSTALLATION
  - A. Equipment Mounting: Install residential water softeners on floor.
    - 1. Maintain manufacturer's recommended clearances.
    - 2. Arrange units so controls and devices that require servicing are accessible.

- B. Equipment Mounting: Install commercial water softeners on concrete base.
  - 1. Maintain manufacturer's recommended clearances.
  - 2. Arrange units so controls and devices that require servicing are accessible.
  - 3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 6. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 7. Anchor water softener and brine tanks to substrate.
- C. Install seismic restraints for tanks and floor-mounting accessories and anchor to building structure.
- D. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.
- E. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.
- F. Install water-testing sets mounted on wall, unless otherwise indicated, and near water softeners.

## 3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to equipment, allow space for service and maintenance of equipment.
- C. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers.
  - 1. Metal general-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
  - 2. Plastic valves are specified in Division 22 Section "Domestic Water Piping."
  - 3. Exception: Water softeners with factory-installed shutoff valves at locations indicated.

- D. Install pressure gages on raw-water inlet and soft-water outlet piping of each mineral tank. Pressure gages are specified in Division 22 Section "Meters and Gages for Plumbing Piping."
  - 1. Exception: Water softeners with factory-installed pressure gages at locations indicated.
  - 2. Exception: Household water softeners.
  - 3. Exception: Water softeners in hot-water service.
- E. Install valved bypass in water piping around water softeners.
  - 1. Metal general-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
  - 2. Plastic valves are specified in Division 22 Section "Domestic Water Piping."
  - 3. Water piping is specified in Division 22 Section "Domestic Water Piping."
  - 4. Exception: Household water softeners.
  - 5. Exception: Water softeners in hot-water service.
- F. Install drains as indirect wastes to spill into open drains or over floor drains.

## 3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

## 3.4 FIELD QUALITY CONTROL

- A. 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 unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Water softeners will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

# 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

- B. Add water to brine tanks and fill with the following form of salt:
  - 1. Commercial Water Softeners: Processed, plain salt pellets.
- C. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples) and prepare certified test reports for required water performance characteristics. Comply with the following:
  - 1. ASTM D 859, "Test Method for Silica in Water."
  - 2. ASTM D 1067, "Test Methods for Acidity or Alkalinity of Water."
  - 3. ASTM D 1068, "Test Methods for Iron in Water."
  - 4. ASTM D 1126, "Test Method for Hardness in Water."
  - 5. ASTM D 1129, "Terminology Relating to Water."
  - 6. ASTM D 3370, "Practices for Sampling Water from Closed Conduits."

### 3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water softeners.

END OF SECTION 22 31 00

# SECTION 22 34 00 - FUEL-FIRED, DOMESTIC-WATER HEATERS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
  - 2. Domestic-water heater accessories.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
  - 1. Wiring Diagrams: For power, signal, and control wiring.

# 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

- 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Product Certificates: For each type of commercial, gas-fired domestic-water heater, from manufacturer.
- C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Warranty: Sample of special warranty.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.
- 1.7 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/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
  - C. ASME Compliance:
    - 1. Where ASME-code construction is indicated, fabricate and label commercial, domesticwater heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
    - 2. Where ASME-code construction is indicated, fabricate and label commercial, finnedtube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
  - D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, NSF 372, "Drinking Water System Components Health Effects."

## 1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Periods: From date of Substantial Completion.
    - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
      - 1) Storage Tank: Three years.
      - 2) Controls and Other Components: Two year(s).
    - b. Compression Tanks: Five years.

## PART 2 - PRODUCTS

- 2.1 COMMERCIAL, GAS-Fired, STORAGE, domestic-WATER HEATERS
  - A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:
    - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      - a. Lochinvar Corporation.
      - b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
      - c. State Industries.
    - 2. Standard: ANSI Z21.10.3/CSA 4.3.
    - 3. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency at optimum operating conditions.

- 4. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.
  - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
    - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
    - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
  - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
  - c. Lining: complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
- 5. Factory-Installed Storage-Tank Appurtenances:
  - a. Anode Rod: Replaceable magnesium.
  - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
  - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
  - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
  - e. Jacket: Steel with enameled finish.
  - f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
  - g. Temperature Control: Adjustable thermostat.
  - h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
  - i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

# 2.2 DOMESTIC WATER HEATER ACCESSORIES

- A. Domestic-Water Compression Tanks:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AMTROL Inc.
    - b. Flexcon Industries.
    - c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.

- d. State Industries.
- e. Taco, Inc.
- f. Bell and Gossett.
- 2. Description: Steel, pressure-rated tank constructed with welded joints and factoryinstalled butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
- 3. Construction:
  - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
  - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
  - c. Air-Charging Valve: Factory installed.
- 4. Capacity and Characteristics:
  - a. Working-Pressure Rating: 150 psig (1035 kPa).
  - b. Capacity Acceptable: 2 gal. minimum.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- D. Heat-Trap Fittings: ASHRAE 90.2.
- E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and calibrated or memory-stop balancing valves to provide balanced flow through each domestic-water heater.
  - 1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
  - 2. Comply with requirements for balancing valves specified in Division 22 Section "Domestic Water Piping Specialties."
- F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.
- G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.
- H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

- I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
  - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- J. Pressure Relief Valves: Include pressure setting less than domestic-water heater workingpressure rating.
  - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.
- L. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.
- M. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

# 2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

## PART 3 - EXECUTION

# 3.1 DOMESTIC WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on 4" tall concrete base.

- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
  - 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
  - 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
  - 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
  - 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Division 23 Section "Facility Natural-Gas Piping."
- D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-waterheater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- G. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."
- H. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements

for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping," and comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

- J. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- K. Fill domestic-water heaters with water.
- L. Charge domestic-water compression tanks with air.

# 3.2 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."
- B. Comply with requirements for fuel-oil piping specified in Division 23 Section "Facility Fuel-Oil Piping."
- C. Comply with requirements for gas piping specified in Division 23 Section "Facility Natural-Gas Piping."
- D. Drawings indicate general arrangement of piping, fittings, and specialties.
- E. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

# 3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

# 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

- 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

# 3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage domestic-water heaters.

END OF SECTION 22 34 00

# SECTION 22 42 12 - COMMERCIAL WATER CLOSETS FLOOR MOUNTED FLOOR OUTLET FLUSH VALVE

## 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. Water closets.
  - 2. Flushometer valves and tanks.
  - 3. Toilet seats.

### 1.3 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Flushometer-Valve Repair Kits: Equal to **10** percent of amount of each type installed, but no fewer than **six** of each type.

### PART 2 - PRODUCTS

- 2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS
  - A. Water Closets: Floor mounted, bottom outlet, top spud.
    - 1. Bowl:
      - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
      - b. Material: Vitreous china.
      - c. Type: Siphon jet.
      - d. Style: Flushometer valve.
      - e. Rim Contour: Elongated.
      - f. Spud Size and Location: NPS 1-1/2; top.
      - g. Color: White.
    - 2. Bowl-to-Drain Connecting Fitting: ASME A112.4.3.

### 2.2 FLUSHOMETER VALVES

- A. Lever-Handle, Diaphragm Flushometer Valves:
  - 1. Standard: ASSE 1037.
  - 2. Minimum Pressure Rating: 125 psig.
  - 3. Features: Include integral check stop and backflow-prevention device.
  - 4. Material: Brass body with corrosion-resistant components.
  - 5. Exposed Flushometer-Valve Finish: Chrome plated.
  - 6. Panel Finish: Chrome plated or stainless steel.
  - 7. Style: Exposed.
  - 8. Minimum Inlet: NPS 1.
  - 9. Minimum Outlet: NPS 1-1/4.

# 2.3 TOILET SEATS

- A. Toilet Seats:
  - 1. Standard: IAPMO/ANSI Z124.5.
  - 2. Material: Plastic.
  - 3. Type: Commercial Standard.
  - 4. Shape: Elongated rim, open front.
  - 5. Hinge: Self-sustaining, check.
  - 6. Hinge Material: Noncorroding metal.
  - 7. Seat Cover: Not required.
  - 8. Color: White.

## PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Water-Closet Installation:
  - 1. Install level and plumb according to roughing-in drawings.
  - 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
  - 3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- B. Flushometer-Valve Installation:
  - 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
  - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
  - 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
- C. Install toilet seats on water closets.

- D. Wall Flange and Escutcheon Installation:
  - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
  - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
  - 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Joint Sealing:
  - 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
  - 2. Match sealant color to water-closet color.
  - 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

### 3.3 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

## 3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

## 3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 12

# SECTION 22 42 15 - COMMERCIAL LAVATORIES

## 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. Lavatories.
  - 2. Faucets.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
  - 1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
    - a. Servicing and adjustments of automatic faucets.

# PART 2 - PRODUCTS

# 2.1 VITROUS, CHINA, WALL HUNG LAVATORIES

- A. Lavatory: Wall mounted.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:
    - a. Kohler.
    - b. American Standard.
    - c. Mansfield.
  - 2. Fixture:
    - a. Standard: ASME A112.19.2/CSA B45.1.
    - b. Type: Wall hung.
    - c. Faucet-Hole Location: Top.
  - 3. Arm Carrier:
    - a. Type: Floor Mounter
    - b. Feet: Four Bolt, to fit in 3-5/8" stud track.
    - c. Arms: adjustable

# 2.2 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61-Annex G, "Drinking Water System Components -Health Effects," for faucet materials that will be in contact with potable water.

# 2.3 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61-Annex G, "Drinking Water System Components -Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Automatic-type, battery-powered, electronic-sensor-operated, mixing, solidbrass valve.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:
    - a. American Standard America.
    - b. Chicago Faucets.
    - c. Delta Faucet.

- d. Kohler Co.
- e. Zurn Industries, LLC; Commercial Brass and Fixtures.
- 2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
- 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 4. General: Include hot- and cold-water mixing, integral to faucet; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.

# 2.4 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61-Annex G, "Drinking Water System Components -Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching watersupply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, integral check stops, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose.
- F. Risers:
  - 1. NPS 3/8.
  - 2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

# 2.5 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/2 by NPS 1-1/4.
  - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch thick brass tube to wall and chrome-plated, brass or steel wall flange.
  - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch thick stainless-steel tube to wall; and stainless-steel wall flange.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildewresistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

# 3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."
# 3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

# 3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

# END OF SECTION 22 42 15

# SECTION 22 42 16 - COMMERCIAL SINKS

## PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Service basins.
  - 2. Handwash sinks.
  - 3. Sink faucets.
  - 4. Laminar-flow, faucet-spout outlets.
  - 5. Supply fittings.
  - 6. Waste fittings.
- B. Related Requirements:
  - 1. Division 22 Section "Residential Plumbing Fixtures" for residential sinks.

# 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
  - 2. Include rated capacities, operating characteristics and furnished specialties and accessories.

# 1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

# 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

# 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Faucet Washers and O-Rings: Equal to 10percent of amount of each type and size installed.
  - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

# PART 2 - PRODUCTS

# 2.1 SERVICE BASINS

- A. Service Basins: Terrazzo, floor mounted.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Acorn Engineering Company.
    - b. Crane Plumbing, L.L.C.
    - c. Florestone Products Co., Inc.
    - d. Stern-Williams Co., Inc.
  - 2. Fixture:
    - a. Standard: IAPMO PS 99.
    - b. Shape: Square.
    - c. Nominal Size: 24 by 24 inches.
    - d. Height: 6 inches.
    - e. Tiling Flange: On two sides.
    - f. Rim Guard: On top surfaces.
    - g. Color: Not applicable.
    - h. Drain: Grid with NPS 3 outlet.
  - 3. Mounting: On floor and flush to wall.
  - 4. Mixing valves check valves
    - a. Provide swing type check valve on piping upstream of mixing valves, with pipes in horizontal positions.
    - b. Provide Center-Guided check valves on piping upstream of mixing valves, with pipes in the vertical position.

- 5. Mop Basin check valves
  - a. Provide swing type check valve on piping upstream of mixing valves, with pipes in horizontal positions.
  - b. Provide Center-Guided check valves on piping upstream of mixing valves, with pipes in the vertical position.

# 2.2 HANDWASH SINKS

- A. Handwash Sinks: Stainless steel, wall mounted.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following
    - a. Elkay Manufacturing Co.
    - b. Just Manufacturing.
  - 2. Fixture:
    - a. Standards: ASME A112.19.3/CSA B45.4 and NSF/ANSI 2.
    - b. Type: Basin with radius corners, back for faucet, and support brackets.
  - 3. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
  - 4. Waste Fittings: Comply with requirements in "Waste Fittings" Article.
  - 5. Support: ASME A112.6.1M, Type II, sink carrier.

# 2.3 SINK FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components Health Effects," for faucet-spout materials that will be in contact with potable water.
  - 1. Manufacturers: Subject to compliance with requirements: comparable product by one of the following:
    - a. American Standard
    - b. Chicago Faucets
    - c. Delta Faucet Company.
    - d. Kohler Co.
  - 2. Standard: ASME A112.18.1/CSA B125.1.
  - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
  - 4. Body Type: Widespread.
  - 5. Body Material: Commercial, solid brass
  - 6. Finish: Chrome plated.

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- 7. Maximum Flow Rate: 1.5 gpm
- 8. Handle(s): Wrist blade.
- 9. Mounting Type: Deck, exposed.
- 10. Spout Type: Swing, solid brass
- 11. Spout Outlet: Laminar flow.

# 2.4 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.
- B. Manufacturers: Subject to compliance with requirements, provide products by the following
  - 1. AM Conservation Group, Inc.
  - 2. Chronomite Laboratories, Inc.
  - 3. NEOPERL, Inc.
  - 4. <Insert manufacturer's name>.
- C. Description: Chrome-plated brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

# 2.5 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching watersupply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key
- F. Risers:
  - 1. NPS 3/8
  - 2. ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

# 2.6 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 (DN 40) offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/2
  - 2. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch thick stainless-steel tube to wall; and stainless-steel wall flange.

# 2.7 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; 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 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.

- E. Install water-supply piping with stop on each supply to each sink faucet.
  - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
  - 2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildewresistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."
- I. Mixing Valves:
  - 1. Check valves:
    - a. Provide swing type check valve on piping upstream of mixing valves, with pipes in horizontal positions.
    - b. Provide Center-Guided check valves on piping upstream of mixing valves, with pipes in the vertical position.
- J. Mop Basin:
  - 1. Check valves:
    - a. Provide swing type check valve on piping upstream of mixing valves, with pipes in horizontal positions.
    - b. Provide Center-Guided check valves on piping upstream of mixing valves, with pipes in the vertical position.
- K. If valves with specified SWP classes

# 3.3 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

# 3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- 3.5 CLEANING AND PROTECTION
  - A. After completing installation of sinks, inspect and repair damaged finishes.
  - B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
  - C. Provide protective covering for installed sinks and fittings.
  - D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

# END OF SECTION 22 42 16

# SECTION 22 42 17 - DRINKING FOUNTAINS

## 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 drinking fountains and related components.

# 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of drinking fountain.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include operating characteristics, and furnished specialties and accessories.

# 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains to include in maintenance manuals.

# PART 2 - PRODUCTS

# 2.1 DRINKING FOUNTAINS

- A. Drinking Fountains.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Haws Corporation.
    - b. Halsey Taylor.
  - 2. Standards: Comply with ICC A117.1 and NSF 61, annex-G.

- 3. Receptor(s):
  - a. Number: Two.
  - b. Bubbler: One for each receptor, with adjustable stream regulator.
  - c. Drain: Grid type with NPS 1-1/4 tailpiece.
- 4. Controls: Push bar.
- 5. Access to Internal Components: Panel in pedestal.
- 6. Supply Piping: NPS 3/8 with shutoff valve.
- 7. Drain Piping: NPS 1-1/4 minimum trap and waste.
- B. Drinking Fountains: Antifreeze, pedestal.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Haws Corporation.
    - b. Stern-Williams Co., Inc .
    - c. Halsey Taylor.
    - d. Murdock-Super Secur; a division of Acorn Engineering Company
  - 2. Standard: Comply with NSF 61, Annex-G.
  - 3. Designed to operate without draining into ground.
  - 4. Supply Fittings: Underground shutoff and flow-control valve assembly.
  - 5. Drain: Grid type with NPS 1-1/4 minimum waste.
  - 6. Bury Depth, Grade to Valve Components: 36 inches.
  - 7. Supply Piping: NPS 1/2.
  - 8. Waste Piping: NPS 2 minimum trap and waste.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

- B. Set pedestal drinking fountains on floor.
- C. Install recessed drinking fountains secured to wood blocking in wall construction.
- D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

# 3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Install ball, gate, or globe shutoff valve on water supply to each fixture. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."
- 3.4 ADJUSTING
  - A. Adjust fixture flow regulators for proper flow and stream height.

# 3.5 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 17

# SECTION 22 42 20 - COMMERCIAL URINALS

# 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. Urinals.
  - 2. Flushometer valves.
- B. Related Requirements:
  - 1. Division 22 Section "Security Plumbing Fixtures" for security urinals.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

## 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

# 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.
  - 2. Waterless Urinal Trap-Seal Cartridges: Equal to 200 percent of amount of each type installed, but no fewer than 12 of each type.
  - 3. Waterless Urinal Trap-Seal Liquid: Equal to 5 gal. for each urinal installed.

# PART 2 - PRODUCTS

# 2.1 STALL URINALS

- A. Urinals refer to plumbing fixture schedule:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following
    - a. American Standard America.
    - b. Kohler Co.
    - c. Zurn Industries, LLC; Commercial Brass and Fixtures.
    - d. Mansfield
  - 2. Fixture:
    - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    - b. Material: Vitreous china.
    - c. Type: Straight or sloped front.
    - d. Strainer: Separate; removable.
    - e. Water Consumption: Water saving.
    - f. Spud Size and Location: NPS 3/4.
    - g. Color: White.
  - 3. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
  - 4. Flushometer Valve:
    - a. Standard: ASME A112.18.1/CSA B125.1.
    - b. Flushing Device: Manufacturer's standard for NPS 1/2 (DN 15) supply; self-closing valve; and wash-down pipe of length matching fixture.

- 5. Waste Fitting:
  - a. Standard: ASME A112.18.2/CSA B125.2.
  - b. Provide and coordinate all accessories required.

## 2.2 URINAL FLUSHOMETER VALVES

- A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:
  - 1. Standard: ASSE 1037.
  - 2. Minimum Pressure Rating: 125 psig.
  - 3. Features: Include integral check stop and backflow-prevention device.
  - 4. Material: Brass body with corrosion-resistant components.
  - 5. Exposed Flushometer-Valve Finish: Chrome plated.
  - 6. Panel Finish: Chrome plated or stainless steel.
  - 7. Style: Exposed or Concealed.
  - 8. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
  - 9. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
  - 10. Consumption: to coordinate with the fixture.
  - 11. Minimum Inlet: NPS 3/4.
  - 12. Minimum Outlet: NPS 3/4.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

- A. Urinal Installation:
  - 1. Install urinals level and plumb according to roughing-in drawings.
  - 2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
  - 3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.

- 4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
- 5. Install trap-seal liquid in waterless urinals.
- B. Support Installation:
  - 1. Install supports, affixed to building substrate, for wall-hung urinals.
  - 2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
  - 3. Use carriers without waste fitting for urinals with tubular waste piping.
  - 4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.
- C. Flushometer-Valve Installation:
  - 1. Install flushometer-valve water-supply fitting on each supply to each urinal.
  - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
  - 3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
  - 4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- D. Wall Flange and Escutcheon Installation:
  - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
  - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
  - 3. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- E. Joint Sealing:
  - 1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
  - 2. Match sealant color to urinal color.
  - 3. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

# 3.3 CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

# 3.4 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

# 3.5 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 20

# DIVISION 23

# SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

## PART 1 – GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Joining Materials
  - 2. HVAC Sleeves
  - 3. HVAC Sleeve Seals
  - 4. HVAC Specialties
- B. Related Sections:
  - 1. Section 23 05 53 Identification for HVAC Piping and Equipment: Labeling and identifying HVAC systems and equipment.

## 1.02 REFERENCES

- A. <u>ASTM International (ASTM)</u> Publications: (Former American Society for Testing and Materials)
  - 1. A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"
  - 2. B32 "Standard Specification for Solder Metal"
  - 3. C1107 "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)"
- B. <u>American Welding Society (AWS)</u> Publications:
  - 1. BRH "Brazing Handbook"
  - 2. A5.8 "Specification for Filler Metals For Brazing And Braze Welding"
  - 3. D1.1 "Structural Welding Code Steel"
  - 4. D10.12 "Guide for Welding Mild Steel Pipe"
- C. <u>Copper Development Association (CDA)</u> Publications:
  - 1. "Copper Tube Handbook"

# 1.03 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. CPVC: Chlorinated polyvinyl chloride plastic.
  - 3. PVC: Polyvinyl chloride plastic.
- 1.04 SUBMITTALS
  - A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
  - B. Submit "Letter of Conformance" indicating specified items selected for use in project with the following supporting data.
    - 1. Coordination Drawings: Detail major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
      - a. Planned piping layout, including valve and specialty locations and valve-stem movement.
      - b. Clearances for installing and maintaining insulation.
      - c. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
      - d. Equipment and accessory service connections and support details.
      - e. Floor plans, elevations, and details to indicate penetrations in walls, and ceilings and their relationship to other penetrations and installations.

# 1.05 QUALITY ASSURANCE

- A. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting plumbing and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases.
  - 1. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design requirements. See drawings for equipment schedules and requirements.

# 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

# 1.07 SEQUENCING AND SCHEDULING

- A. Coordinate HVAC equipment installation with other building components.
- B. Arrange for pipe spaces and openings in building structure during progress of construction to allow for mechanical installations.
- C. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work.
- D. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.
- 1.08 Posted Operating Instructions
  - A. Provide and post operating instructions for all HVAC systems.

#### PART 2 PRODUCTS

- 2.01 MANUFACTURERS
  - A. Approved Manufacturers:
    - 1. HVAC Sleeve Seals:
      - a. Metraflex Inc. (800-621-4347)
      - b. <u>PSI-Thunderline/Link-Seal</u> (800-423-2410)
- 2.02 JOINING MATERIALS
  - A. Solder Filler Metals: <u>ASTM</u> B32.
    - 1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
    - 2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
    - 3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
    - 4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
    - 5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.
  - B. Brazing Filler Metals: <u>AWS</u> A5.8.
    - 1. BCuP Series: Copper-phosphorus alloys.
    - 2. BAg1: Silver alloy.
    - 3. Welding Filler Metals: Comply with <u>AWS</u> D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

# 2.03 HVAC SLEEVES

- A. Sleeves: The following materials are for wall, and roof penetrations:
  - 1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
  - 2. Steel Pipe: <u>ASTM</u> A53, Type E, Grade A, Schedule 40, galvanized, plain ends.

- 3. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - a. Underdeck Clamp: Clamping ring with set screws.

## 2.04 HVAC SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

#### 2.05 HVAC SPECIALTIES

- A. Grout:
  - 1. Non-shrink, Nonmetallic Grout: <u>ASTM</u> C1107, Grade B.
    - a. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, non-corrosive, nongaseous, and recommended for interior and exterior applications.
    - b. Design Mix: 5000-psig, 28-day compressive strength.
    - c. Packaging: Premixed and factory packaged.

#### PART 3 EXECUTION

- 3.01 HVAC PIPING SYSTEMS COMMON REQUIREMENTS
  - A. General: Install HVAC piping as described below, unless piping Sections specifies otherwise. Individual Division 23 Piping Sections specifies unique piping installation requirements.
  - B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings as required by Division 01 Sections and as outlined in Part 1 of this section.
  - C. Install components with pressure rating equal to or greater than system operating pressure.
  - D. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
  - E. Install piping free of sags and bends.
  - F. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
  - G. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
  - H. Install piping to allow application of insulation plus 1-inch clearance around insulation.
  - I. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
    - 1. Cut sleeves to length for mounting flush with both surfaces.
      - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping rings where required.

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- 2. Build sleeves into walls and slabs as work progresses.
- 3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
- 4. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant.
- J. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- K. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
  - 1. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  - 2. Soldered Joints: Construct joints according to <u>CDA</u>'s "Copper Tube Handbook."
  - 3. Brazed Joints: Construct joints according to <u>AWS</u>'s "Brazing Handbook," Chapter "Pipe and Tube."

3.02 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights is not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Owner's Representative.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- E. Clearance from Electrical Equipment: Piping and ductwork are prohibited in electric rooms and closets, elevator machine rooms and installation over transformers, switchboards and motor control centers.

# 3.03 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Prime and paint all metal supports per Section 09 90 00 requirements similar to "Pipes and Mechanical Equipment".

# 3.04 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.
- C. Refer to Division 01 Sections for additional requirements.

#### 3.05 GROUTING

- A. Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placing of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases to provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 23 05 00

# SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

## PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Basic Motor Requirements
  - 2. Polyphase Motors
  - 3. Single Phase Motors
- B. Related Sections:
  - 1. Division 23 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

#### 1.02 REFERENCES

- A. Institute of Electrical and Electronics Engineers (IEEE) Publications:
  - 1. 112 "Standard Test Procedure for Polyphase Induction Motors and Generators"
- B. National Electrical Manufacturer's Association (NEMA) Standards Publications:
  - 1. MG 1 "Motors and Generators"
- C. National Fire Protection Association (NFPA) Publications:
  - 1. 70 "National Electric Code"

# 1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Product Data: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

# 1.04 QUALITY ASSURANCE

- A. Comply with <u>NFPA</u> 70.
- B. Listing and Labeling: Provide motors specified in this Section that are listed and labeled.
  - 1. Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.

# PART 2 PRODUCTS

- 2.01 BASIC MOTOR REQUIREMENTS
  - A. Basic requirements apply to mechanical equipment motors, unless otherwise indicated.
  - B. Motors 1/2 HP and Larger: Polyphase.

#### COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

- C. Motors Smaller than 1/2 HP: Single phase.
- D. Frequency Rating: 60 Hz.
- E. Voltage Rating: Determined by voltage of circuit to which motor is connected.
- F. Service Factor: According to <u>NEMA</u> MG 1, general purpose continuous duty, design type "B."
- G. Capacity and Torque Characteristics: Rated for continuous duty and sufficient to start, accelerate, and operate connected loads at designated speeds, in indicated environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Enclosure: Open drip-proof, unless otherwise indicated.
- I. Efficiency: Motors shall have a higher efficiency rating than industry standard average motor as delineated in <u>IEEE</u> Standard 112, Test Method 13.

#### 2.02 POLYPHASE MOTORS

- A. Description: <u>NEMA MG 1</u>, medium induction motor.
  - 1. Design Characteristics: <u>NEMA MG 1</u>, Design B, unless otherwise indicated.
  - 2. Energy-Efficient Design: Where indicated.
  - 3. Stator: Copper windings, unless otherwise indicated. Multi-speed motors have separate winding for each speed.
  - 4. Rotor: Squirrel cage, unless otherwise indicated.
  - 5. Bearings: Double-shielded, pre-lubricated ball bearings suitable for radial and thrust loading.
  - 6. Temperature Rise: Match insulation rating, unless otherwise indicated.
  - 7. Insulation: Class F, unless otherwise indicated.
- B. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for indicated controller, with required motor leads brought to motor terminal box to suit control method.
- C. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Critical vibration frequencies are not within operating range of controller output.
  - 2. Temperature Rise: Match rating for Class B insulation.
  - 3. Insulation: Class H
  - 4. Thermal Protection: Where indicated, conform to <u>NEMA MG 1</u> requirements for thermally protected motors.
- D. Source Quality Control: Perform the following routine tests according to <u>NEMA MG 1</u>:
  - 1. Measurement of winding resistance.
  - 2. No-load readings of current and speed at rated voltage and frequency.
  - 3. Locked rotor current at rated frequency.
  - 4. High-potential test.
  - 5. Alignment

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## 2.03 SINGLE-PHASE MOTORS

- A. Type: As indicated or selected by manufacturer from one of the following, to suit starting torque and other requirements of specific motor application.
  - 1. Permanent-split capacitor.
  - 2. Split-phase start, capacitor run.
  - 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: Do not use, unless motors are smaller than 1/20 hp.
- C. Thermal Protection: Where indicated or required, internal protection automatically opens power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device automatically resets when motor temperature returns to normal range, unless otherwise indicated.
- D. Bearings: Ball-bearing type for belt-connected motors and other motors with high radial forces on motor shaft. Sealed, pre-lubricated sleeve bearings for other single-phase motors.

#### PART 3 EXECUTION

# 3.01 ADJUSTING

- A. Use adjustable motor mounting bases for belt-driven motors.
- B. Align pulleys and install belts.
- C. Tension according to manufacturer's written instructions.

# 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. Thermal-hanger shield inserts.
  - 4. Fastener systems.
  - 5. Equipment supports.

## 1.2 PERFORMANCE REQUIREMENTS

- A. 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 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.

# 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following. include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Equipment supports.

# 1.4 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

# PART 2 - PRODUCTS

- 2.1 Approved Manufacturers:
  - A. Pipe Hangers, Supports, and Components:
    - 1. Cooper B-Line, Inc. (618-654-2184)
    - 2. Grinnell Mechanical Products, A Tyco International Company (800-500-4768)
    - 3. National Pipe Hanger Corporation (609-261-5353)
  - B. Channel Support Systems:
    - 1. Cooper B-Line, Inc. (618-654-2184)
    - 2. Grinnell Mechanical Products, A Tyco International Company (800-500-4768)
    - 3. National Pipe Hanger Corporation (609-261-5353)
  - C. Thermal-Hanger Shield Inserts:
    - 1. Carpenter & Patterson, Inc. (301.333.4631)
    - 2. Erico (Michigan Hanger) (440-248-0100)
    - 3. PHS Industries, Inc. (800-626-2336)
  - D. Powder-Actuated and Mechanical Anchor Fastener Systems:
    - 1. Gunnebo Fastening Corp. (800-336-1640)
    - 2. Hilti, Inc.(800-879-8000)
    - 3. ITW Ramset/Red Head (800-899-7890)

# 2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pre-galvanized 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.

# 2.3 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.

# 2.4 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

# 2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- 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.

# 2.6 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, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Non-staining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

# 3.1 HANGER AND SUPPORT 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 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution 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 weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - 5. 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 1-1/2 inches.

## 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. 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 metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel 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 non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
  - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steelpipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steelpipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with Ubolt to retain pipe.
  - 8. 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.
  - 9. 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.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg 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-joist construction, to attach to top flange of structural shape.
  - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  - 6. C-Clamps (MSS Type 23): For structural shapes.
  - 7. 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.
  - 8. Side-Beam Brackets (MSS Type 34): For sides of steel beams.
  - 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 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. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

## END OF SECTION 23 05 29

# SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS 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. Elastomeric isolation pads.
  - 2. Elastomeric isolation mounts.
  - 3. Restrained elastomeric isolation mounts.
  - 4. Open-spring isolators.
  - 5. Housed-spring isolators.
  - 6. Restrained-spring isolators.
  - 7. Housed-restrained-spring isolators.
  - 8. Pipe-riser resilient support.
  - 9. Resilient pipe guides.
  - 10. Air-spring isolators.
  - 11. Restrained-air-spring isolators.
  - 12. Elastomeric hangers.
  - 13. Spring hangers.
  - 14. Snubbers.
  - 15. Restraints rigid type.
  - 16. Restraints cable type.
  - 17. Restraint accessories.
  - 18. Post-installed concrete anchors.
  - 19. Concrete inserts.
  - 20. Vibration isolation equipment bases.
  - 21. Restrained isolation roof-curb rails.

#### 1.3 DEFINITIONS

- A. Designated Seismic System: An HVAC component that requires design in accordance with ASCE/SEI 7, Ch. 13, and for which the Component Importance Factor is greater than 1.0.
- B. IBC: International Building Code.

C. OSHPD: Office of Statewide Health Planning and Development (for the State of California owned and regulated medical facilities).

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Include load rating for each wind-force-restraint fitting and assembly.
  - 3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-[and wind-force-]restraint component.
  - 4. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by [ICC-ES product listing] [UL product listing] [FM Approvals] [an evaluation service member of ICC-ES] [OSHPD] [an agency acceptable to authorities having jurisdiction].
  - 5. Annotate to indicate application of each product submitted and compliance with requirements.
  - 6. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
  - 1. Detail fabrication and assembly of equipment bases.
  - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Welding certificates.
- C. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7, and be acceptable to authorities having jurisdiction.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic and wind-load control system.
  - Seismic and Wind-Load Performance: Equipment shall withstand the effects of earthquake motions and high wind events determined in accordance with ASCE/SEI 7-10.
- B. Seismic Design Calculations:
  - 1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in other seismic calculation method required by authorities having jurisdiction. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is the edition intended as reference throughout the Section Text.
    - a. Data indicated below to be determined by Delegated-Design Contractor must be obtained by Contractor and must be included in individual component submittal packages.
    - b. Coordinate seismic design calculations with wind-load calculations for equipment mounted outdoors. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.
    - c. Building Construction: IIB
    - d. Building Risk Category: II
    - e. Building Site Classification: D
- C. Wind-Load Design Calculations:
  - Perform calculations to obtain force information necessary to properly select wind-loadrestraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7-10. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is intended as referenced throughout the Section Text unless otherwise noted.
    - a. Data indicated below that are specific to individual pieces of equipment must be obtained by Contractor and must be included in individual component submittal packages.
    - b. Coordinate design wind-load calculations with seismic load calculations for equipment requiring both seismic and wind-load reinforcement. Comply with

requirements in other Sections in addition to those in this Section for equipment mounted outdoors.

- D. Component Supports:
  - 1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
  - 2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7-10 Section 13.6

# 2.2 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads: .
  - 1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
  - 2. Size: Factory or field cut to match requirements of supported equipment.
  - 3. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
  - 4. Surface Pattern: Smooth, ribbed, or waffle pattern.
  - 5. Infused nonwoven cotton or synthetic fibers.
  - 6. Load-bearing metal plates adhered to pads.
  - 7. Sandwich-Core Material: Resilient and elastomeric
    - a. Surface Pattern: Smooth, ribbed, or waffle pattern.
      - b. Infused nonwoven cotton or synthetic fibers.

# 2.3 ELASTOMERIC HANGERS

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
  - 1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
  - 2. Damping Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

# 2.4 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
  - 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

- 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
- 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
- 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
- 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
- 8. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

## 2.5 SNUBBERS

- A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
  - 1. Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors.
  - 2. Anchors in Masonry: Design in accordance with TMS 402.
  - 3. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
  - 4. Resilient Cushion: Maximum 1/4-inch (6-mm) air gap, and minimum 1/4 inch (6 mm) thick.

# 2.6 RESTRAINED ISOLATION ROOF-CURB RAILS

- A. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.
- B. Upper Frame: To provide continuous support for equipment and to be captive to resiliently resist seismic and wind forces.
- C. Lower Support Assembly: To be formed sheet metal section containing adjustable and removable steel springs that support the upper frame. Lower support assembly to have a means for attaching to building structure and a wood nailer for attaching roof materials, and to be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly. Mount adjustable, restrained-spring isolators on elastomeric vibration isolation pads and provide access ports, for level adjustment, with removable waterproof covers at all isolator locations. Locate isolators so they are accessible for adjustment at any time during the life of the installation without interfering with integrity of roof.
- D. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch (6 mm) thick.

E. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 APPLICATIONS

A. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static, and wind, and seismic loads within specified loading limits.

## 3.3 INSTALLATION OF VIBRATION-CONTROL, WIND LOAD AND SEISMIC-RESTRAINT DEVICES

- A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Devices Schedules, where indicated on Drawings, or where Specifications indicate they are to be installed on specific equipment and systems.
- B. Provide seismic-restraint and wind-load control devices for systems and equipment where indicated in Equipment Schedules or Seismic-Restraint Devices Schedules, where indicated on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
- C. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points.
- D. Installation of vibration isolators, wind-load restraints, must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- E. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

- F. Equipment Restraints:
  - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
  - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
  - 3. Install seismic-restraint, and wind-load-restraint devices using methods approved by an evaluation service member an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- G. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- I. Mechanical Anchor Bolts:
  - Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
  - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

# 3.4 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT BASES

- A. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate dimensions of steel equipment rails and bases, concrete inertia bases, and restrained isolation roof-curb rails with requirements of isolated equipment specified in this

and other Sections. Where dimensions of these bases are indicated on Drawings, dimensions may require adjustment to accommodate actual isolated equipment.

#### 3.5 ADJUSTING

- A. Adjust isolators after system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

## 3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
  - 1. Perform tests and inspections with the assistance of a factory-authorized service representative.
  - 2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Units will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 230548

## SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

## PART 1 GENERAL

## 1.01 SUMMARY

- A. Section Includes:
  - 1. Identifying Devices and Labels
- B. Related Sections:
  - 1. Section 23 05 00 (15050) Common Work Results for HVAC

## 1.02 REFERENCES

- A. <u>ASTM International (ASTM)</u> Publications: (Former American Society for Testing and Materials)
  - 1. C1036 "Standard Specification for Flat Glass"
- B. <u>The American Society of Mechanical Engineers (ASME)</u> Publications:
  - 1. A13.1 "Scheme for the Identification of Piping Systems"

## 1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Product Data: For identification materials and devices.
  - 2. Samples: Of color, lettering style, and graphic representation required for each identification material and device.

## 1.04 QUALITY ASSURANCE

A. Comply with <u>ASME</u> A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

## 1.05 SEQUENCING AND SCHEDULING

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

## PART 2 PRODUCTS

- 2.01 GENERAL
  - A. General: Products specified are for applications referenced in other Division 23 Sections. If more than single type is specified for listed applications, selection is Installer's option.
  - B. Pipes Including Insulation: Full-band pipe markers, extending 360 degrees around pipe at each location.

#### 2.02 IDENTIFYING DEVICES AND LABELS

- A. Lettering: Manufacturer's standard preprinted captions as selected by Owner's Representative.
- B. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
  - 1. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.
- C. Plastic Duct Markers: Manufacturer's standard laminated plastic, in the following color codes:
  - 1. Green: Cold-air supply.
  - 2. Yellow: Hot-air supply.
  - 3. Blue: Exhaust, outside, return, and mixed air.
  - 4. Terminology: Include direction of airflow; duct service such as supply, return, and exhaust; duct origin, duct destination, and design flow.
- D. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive, vinyl tape, at least 3 mils thick.
  - 1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
  - 2. Color: Comply with <u>ASME</u> A13.1, unless otherwise indicated.
- E. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.
  - 1. Material: 0.032-inch thick, polished brass.
  - 2. Size: 1-1/2-inches diameter, unless otherwise indicated.
- F. Valve Tag Fasteners: Brass, wire-link chain and S-hooks.
- G. VAV Box Labels: Install label on ceiling grid below VAV box. Label shall be clear with black letters.
- H. Access Panel Markers: 1/16-inch thick, engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch center hole for attachment.
- I. Valve Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include screws.
  - 1. Frame: Extruded aluminum.
  - 2. Glazing: <u>ASTM</u> C1036, Type I, Class 1, Glazing quality B, 2.5-mm, single-thickness glass.
- J. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.
  - 1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

#### PART 3 EXECUTION

#### 3.01 LABELING AND IDENTIFYING PIPING SYSTEMS

- A. Install pipe markers on each system as indicated below. Include arrows showing normal direction of flow.
  - 1. Gas.
  - 2. Condensate.
  - 3. Refrigerant
- B. Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, non-insulated pipes.
- C. Fasten markers on pipes and insulated pipes by one of following methods:
  - 1. Snap-on application of pretensioned, semirigid plastic pipe marker.
- D. Locate pipe markers where piping is exposed in machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations according to the following:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
  - 3. Near penetrations through walls, floors, ceilings, or non-accessible 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 a maximum of 50-foot intervals along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- 3.02 VALVE TAGS
  - A. Install on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in valve schedule.
  - B. Tag Material: Brass.
  - C. Tag Size and Shape: According to the following:
    - 1. Refrigeration: 1-1/2 inches round.
    - 2. Gas: 1-1/2 inches round.
  - D. Install framed valve schedule in each major mechanical equipment room.
  - E. Valve schedule and tag locations shall be shown on record drawings.

#### 3.03 LABELING AND IDENTIFYING DUCT SYSTEMS.

- A. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows showing service and direction of flow.
  - 1. Location: Locate signs near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.
- 3.04 ADJUSTING AND CLEANING
  - A. Relocate HVAC identification materials and devices that have become visually blocked by work of this or other Divisions.
  - B. Clean faces of identification devices and glass frames of valve charts

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Variable-volume air systems.

## 1.2 DEFINITIONS

- A. NEBB: National Environmental Balancing Bureau.
- B. TAB: Testing, adjusting, and balancing.
- C. TAB Specialist: An entity engaged to perform TAB Work.

#### 1.3 SUBMITTALS

A. Certified TAB reports.

## 1.4 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB.
  - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB.
  - 2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB as a TAB technician.
- B. 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.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by Owner.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

PART 2 - PRODUCTS (Not Applicable)

#### PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, 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 used for supply and return air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "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 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, and equipment with functioning controls is ready for operation.
- J. Examine fan coil units and verify that they are accessible and their controls are connected and functioning.

- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine operating safety interlocks and controls on HVAC equipment.
- M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

## 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Automatic temperature-control systems are operational.
  - 3. Equipment and duct access doors are securely closed.
  - 4. Balance dampers are open.
  - 5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 6. Windows and doors can be closed so indicated conditions for system operations can be met.

## 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems".
  - 1. Comply with requirements in ASHRAE 62.1-2004, 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 same material and thickness as used to construct ducts.
  - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "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.

#### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For fan coil units, 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 exhaustair 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 Division 23 Section "Metal Ducts."

## 3.5 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. Setmaximum airflow and adjust controller or regulator to deliver the designed maximum airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
- 5. Set AHU 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.

## 3.6 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.

## 3.7 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each refrigerant coil:
  - 1. Dry-bulb temperature of entering and leaving air.
  - 2. Airflow.
  - 3. Air pressure drop.
  - 4. Refrigerant suction pressure and temperature.

## 3.8 CONDENSING UNITS

A. Verify proper rotation of fans and measure entering and leaving air temperatures. Record compressor data.

## 3.9 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: Plus or minus 10 percent.
  - 2. Air Outlets and Inlets: Plus or minus 10 percent.
  - 3. Heat Pump, Boiler, Fluid Cooler Water Flow Rate: Plus or minus 10 percent.

## 3.10 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

## 3.11 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. Fan curves.

- 2. Manufacturers' test data.
- 3. Field test reports prepared by system and equipment installers.
- 4. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  - 1. Title page.
  - 2. Name and address of the TAB 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 fan performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Fan drive settings.
    - e. Settings for supply-air, static-pressure controller.
    - f. Other system operating conditions that affect performance.

## 3.12 ADDITIONAL TESTS

- A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION 23 05 93

## SECTION 23 07 13 - DUCT 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 duct services:
  - 1. Indoor, concealed supply, return air.
- B. Related Sections:
  - 1. Division 23 Section "HVAC Equipment Insulation."
  - 2. Division 23 Section "HVAC Piping Insulation."
  - 3. Division 23 Section "Metal Ducts" for duct liners.

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

## 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 Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### 1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

#### PART 2 - PRODUCTS

#### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- F. Approved Manufacturers:
  - 1. Mineral-Fiber Insulation:
    - a. CertainTeed Corp. (610-647-3011)
    - b. Knauf Insulation. (800-825-4434)
    - c. Owens-Corning Fiberglas Corp. (800-447-3759)
  - 2. Mineral-Fiber Blanket Thermal Insulation:
    - a. CertainTeed Corp. (610-647-3011)
    - b. Knauf Insulation. (800-825-4434)
    - c. Owens-Corning Fiberglas Corp. (800-447-3759)
  - 3. Closed-Cell Phenolic-Foam Insulation:
    - a. "Kooltherm Pipe Insulation"; Kingspan Insulation Ltd. (904-486-0553).
  - 4. Flexible Elastomeric Thermal Insulation:
    - a. Armstrong World Industries (800-448-1405)

b. Rubatex International LLC (800-782-2839)

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
    - e. Or approved by Engineer as equal.
  - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
    - e. Or approved by Engineer as equal.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.3 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

- 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
  - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
  - c. Vimasco Corporation; 713 and 714.
  - d. Or approved by Engineer as equal.
- 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fireresistant lagging cloths over duct insulation.
- 4. Service Temperature Range: 0 to plus 180 deg F.
- 5. Color: White.

## 2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    - b. Eagle Bridges Marathon Industries; 405.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Or approved by Engineer as equal.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: Aluminum.
  - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

# 2.6 FIELD-APPLIED JACKETS

- A. Metal Jacket:
  - 1. Aluminum Jacket: Comply with ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    - a. Sheet and roll stock ready for shop or field sizing.
    - b. Finish and thickness are indicated in field-applied jacket schedules.

## 2.7 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 491 AWF FSK.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
    - e. Or approved by Engineer as equal.
  - 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 488 AWF.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - c. Compac Corporation; 120.
    - d. Venture Tape; 3520 CW.
    - e. Or approved by Engineer as equal.
  - 2. Width: 2 inches.
  - 3. Thickness: 3.7 mils.
  - 4. Adhesion: 100 ounces force/inch in width.

- 5. Elongation: 5 percent.
- 6. Tensile Strength: 34 lbf/inch in width.

## 2.8 SECUREMENTS

- A. Bands:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ITW Insulation Systems; Gerrard Strapping and Seals.
    - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
    - c. Or approved by Engineer as equal.
  - 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inches thick, 1/2 inches wide with wing seal or closed seal.
  - 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inches thick, 1/2 inches wide with wing seal or closed seal.
- B. Insulation Pins and Hangers:
  - 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) AGM Industries, Inc.; CWP-1.
      - 2) GEMCO; CD.
      - 3) Midwest Fasteners, Inc.; CD.
      - 4) Nelson Stud Welding; TPA, TPC, and TPS.
      - 5) Or approved by Engineer as equal.
  - 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) AGM Industries, Inc.; CHP-1.
      - 2) GEMCO; Cupped Head Weld Pin.
      - 3) Midwest Fasteners, Inc.; Cupped Head.
      - 4) Nelson Stud Welding; CHP.
      - 5) Or approved by Engineer as equal.
  - 3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely

in position indicated when self-locking washer is in place. Comply with the following requirements:

- a. Products: Subject to compliance with requirements, provide one of the following:
  - 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
  - 2) GEMCO; Perforated Base.
  - 3) Midwest Fasteners, Inc.; Spindle.
  - 4) Or approved by Engineer as equal.
- b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inches thick by 2 inches square.
- c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inchdiameter shank, length to suit depth of insulation indicated.
- d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; RC-150.
    - 2) GEMCO; R-150.
    - 3) Midwest Fasteners, Inc.; WA-150.
    - 4) Nelson Stud Welding; Speed Clips.
    - 5) Or approved by Engineer as equal.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inchthick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) GEMCO.
    - 2) Midwest Fasteners, Inc.
    - 3) Or approved by Engineer as equal.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

- D. Wire: 0.062-inch soft-annealed, stainless steel.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C & F Wire.
    - b. Or approved by Engineer as equal.

## 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 ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.

- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

#### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.

# 3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area.
  - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not over-compress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1

inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vaporbarrier seal.
- Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
- 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
- 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

# 3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
  - 1. Draw jacket material smooth and tight.
  - 2. Install lap or joint strips with same material as jacket.
  - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
  - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

## 3.7 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  - 1. Indoor, supply air.
- B. Items Not Insulated:

- 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
- 2. Factory-insulated flexible ducts.
- 3. Factory-insulated plenums and casings.
- 4. Flexible connectors.
- 5. Vibration-control devices.
- 6. Factory-insulated access panels and doors.

# 3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE.

- A. Supply-air duct:
  - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu.ft. nominal density with factory-applied FSK jacket.

## SECTION 23 07 19 - HVAC 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 HVAC piping systems:
  - 1. Condensate drain piping, indoors.
  - 2. Refrigerant suction and hot gas piping.
- B. Related Sections:
  - 1. Division 23 Section "Duct Insulation."

## 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

## 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 Division 23 Section "Hangers and Supports for HVAC 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. 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. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, and Aboveground Piping Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Flexible Elastomeric Insulation: Closed-cell, EPDM-rubber. Comply with ASTM C 1534 for tubular materials.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.
- F. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Knauf Insulation; 1000-Degree Pipe Insulation.
    - b. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
    - e. Or approved by Engineer as equal.
  - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
    - e. Or approved by Engineer as equal.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products: Subject to compliance with requirements, provide 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. Speedline Corporation; Polyco VP Adhesive.
- e. Or approved by Engineer as equal.

## 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
    - c. Or approved by Engineer as equal.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    - b. Marathon Industries; 570.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
    - d. Or approved by Engineer as equal.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
  - 3. Service Temperature Range: Minus 50 to plus 220 deg F.
  - 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  - 5. Color: White.

## 2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
  - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
    - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    - c. Vimasco Corporation; 713 and 714.
    - d. Or approved by Engineer as equal.
  - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fireresistant lagging cloths over pipe insulation.
  - 4. Service Temperature Range: 0 to plus 180 deg F.
  - 5. Color: White.

#### 2.5 SEALANTS

- A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    - b. Or approved by Engineer as equal.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: White.
  - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

#### 2.6 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.

## 2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
    - e. Or approved by Engineer as equal.
  - 2. Adhesive: As recommended by jacket material manufacturer.
  - 3. Color: White.
  - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

## 2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
    - e. Or approved by Engineer as equal.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. ABI, Ideal Tape Division; 370 White PVC tape.
    - b. Compac Corporation; 130.
    - c. Venture Tape; 1506 CW NS.
    - d. Or approved by Engineer as equal.
  - 2. Width: 2 inches.
  - 3. Thickness: 6 mils.
  - 4. Adhesion: 64 ounces force/inch in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch in width.

## 2.9 SECUREMENTS

- A. Bands:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ITW Insulation Systems; Gerrard Strapping and Seals.
    - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
    - c. Or approved by Engineer as equal.
  - 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inches thick, 1/2 inches wide with wing seal or closed seal.
  - 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inches thick, 1/2 inches wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C & F Wire.
    - b. Or approved by Engineer as equal.

#### 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.
  - 3. 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.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.

- 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
- 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

#### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

## 3.5 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, 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. 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.

- 6. 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.

## 3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install mitered sections of pipe insulation.
  - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesives to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.
  - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

# 3.7 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
  - 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

- B. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- C. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 4. Install insulation to flanges as specified for flange insulation application.

## 3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
  - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

## 3.9 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.

## 3.10 PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 1" thick.

# 3.11 PIPING SYSTEM APPLICATION SCHEDULE

	<u>Service</u>	<u>Material</u>	<u>Thickness</u>	Field Applied	<u>Finish</u>
				<u>Jacket</u>	
Α.	Refrigerant suc-	Flexible elas-	Copper	Aluminum	None
	tion piping	tomeric,	Piping	Jacket on	
		EPDM type	ALL sizes:	Exterior Ex-	
			3/4"	posed Piping	

END OF SECTION 23 07 19

## SECTION 23 09 00 - HVAC TEMPERATURE CONTROLS

#### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes control equipment and components. DDC system shall control HVAC systems as directed by the sequence of operations.

Some HVAC equipment will be provided with factory controls. Temperature Control Contractor shall coordinate all control devices with HVAC equipment manufacturers to ensure that a complete system is provided.

B. See Division 23 Section "Sequence of Operation for HVAC Temperature Controls" for requirements that relate to this Section. It shall be the responsibility of the controls contractor to ensure the devices furnished with any equipment will integrate with the Sequence of Operation in stated in the next specification section.

#### 1.2 SUBMITTALS

- A. Product Data: For each control device indicated.
- B. Shop Drawings:
  - 1. Schematic flow diagrams.
  - 2. Power, signal, and control wiring diagrams.
  - 3. Details of control panel faces.
  - 4. Damper schedule.
  - 5. DDC System Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
  - 6. Control System Software: Schematic diagrams, written descriptions, and points list.
- C. Software and firmware operational documentation.
- D. Field quality-control test reports.
- E. Operation and maintenance data.

## 1.3 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. PART 2 - PRODUCTS

- 2.1 CONTROL SYSTEM
  - A. Vendors:
    - 1. Automated Logic.
    - 2. Carrier.
    - 3. Jackson Systems.
    - 4. Johnson Controls.
    - 5. OCS.
    - 6. Siemens.
    - 7. Trane.
  - B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

## 2.2 DDC EQUIPMENT

- A. The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.
- B. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a web browser over the control system network, the local area network and the internet. The thin-client architecture provides operators complete access to the control system to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.
- C. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between the control modules. I/O points, schedules, setpoints, trends and alarms shall be BACnet objects.
- D. Hardware shall have sufficient memory to store all required operator workstation software, a DDC database at least twice the size of the delivered system database, and one year of trend data based on the points specified to be trended at their specified trend intervals.
- E. The operator interface software shall be graphically based and include at least one graphic per piece of equipment or occupied zone, and graphics that summarize the conditions on each floor. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperatures in relative to zone setpoint.
- F. Communication web server and controller shall communicate using BACnet protocol and backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

G. Furnish temperature control panel in the mechanical room. Data connection point shall be provided by electrical contractor near the control panel for network access. Provide all programming and graphics required to access and control the HVAC systems as directed by the sequence of operations.

# 2.3 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
  - 1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
  - 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
  - 3. Non-spring-Return Motors for Valves Larger than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
  - 4. Spring-Return Motors for Valves Larger than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
  - 5. Non-spring-Return Motors for Dampers Larger than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
  - 6. Spring-Return Motors for Dampers Larger than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
  - 1. Available Manufacturers:
    - a. Belimo Aircontrols (USA), Inc.
  - 2. Dampers: Size for running torque calculated as follows:
    - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
    - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
    - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
    - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
    - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
    - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
  - 3. Coupling: V-bolt and V-shaped, toothed cradle.
  - 4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.

- 5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
- 6. Power Requirements (Two-Position Spring Return): 24-V ac.
- 7. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
- 8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.

## 2.4 VARIABLE FREQUENCY CONTROLLERS

A. Provided by BMS contractor and installed by Electrical Contractor. Refer to Section Variable Frequency Controllers, Section 23 09 01, for requirements.

## 2.5 DAMPERS

- A. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
  - 1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
  - 2. Operating Temperature Range: From minus 40 to plus 200 deg F.
  - 3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.

## 2.6 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Verify location of thermostats, and other exposed control sensors with Drawings and room details before installation.
- B. Install automatic dampers according to Division 23 Section "Air Duct Accessories."
- C. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

- D. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."
- E. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."
- F. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

# 3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling" and as directed below:
  - 1. Install cables in raceway in mechanical rooms and areas where other conduit and piping are exposed.
  - 2. Install cables concealed by drywall in raceway.
  - 3. Install cables above accessible ceilings using J-hooks. Exposed cables to be plenum rated.
  - 4. Bundle and harness multiple cables using Velcro straps.
  - 5. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
  - 6. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

## 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
  - 2. Test and adjust controls and safeties.

- 3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
- 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
- 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
- 6. Test each system for compliance with sequence of operation.
- 7. Test software and hardware interlocks.
- C. DDC Verification:
  - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
  - 2. Check instruments for proper location and accessibility.
  - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
  - 4. Check instrument tubing for proper fittings, slope, material, and support.
  - 5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
  - 6. Check temperature instruments and material and length of sensing elements.
  - 7. Check control valves. Verify that they are in correct direction.
  - 8. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
  - 9. Check DDC system as follows:
    - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    - c. Verify that spare I/O capacity has been provided.
    - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

# 3.4 POST START UP

A. BMS contractor shall include 24 hours of re-programming and call back time during the first 12 months of operation to handle set point adjustments, owner and engineer initiated programming changes, and other related items as they pertain to an efficient operating control system.

## 3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 09 00

## SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

#### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. Related Sections include the following:
  - 1. Section 23 09 00 "Instrumentation and Control for HVAC" for control equipment and devices.
- C. Temperature control contractor shall coordinate with electrical contractor and fire alarm contractor for control integration. Provide all devices, interlock wiring, relays, sensors, etc. to provide the sequence of operations.

## 1.3 RTU-1 CONTROL SEQUENCE

- A. Supply Fan
  - 1. Occupied mode:
    - a. Fan shall run continuously.
  - 2. Unoccupied mode:
    - a. Fan shall run intermittently to maintain unoccupied space temperature setpoints.
  - 3. Fan speed control:
    - a. Controls shall modulate fan to maintain duct static pressure setpoint. Duct static pressure setpoint to be reset based on VAV box positions (maintain 2 boxes at 100% open or use manufacturer's standard duct pressure optimization routine).
- B. Outdoor Air Control
  - 1. Occupied mode:

- a. Outdoor air damper shall be open to minimum position.
- b. If return air CO2 rises above setpoint (1000 ppm, adjustable), modulate unit outdoor air damper (up to higher minimum position limit) to maintain space CO2 setpoint.
- 2. Unoccupied mode:
  - a. Outdoor air damper shall be closed.
- 3. Economizer mode:
  - a. Modulate outdoor air and return air dampers on calls for cooling to maintain leaving air temperature setpoint when outdoor conditions are acceptable.
- 4. Modulate power exhaust fan speed to maintain slight space positive pressure (+0.03", adjustable).
- C. Temperature Control
  - 1. Controls shall stage compressors and heating to maintain discharge air temperature setpoint.
    - a. When OAT is above 50F, SAT shall be 55F.
    - b. When OAT is below 20F, SAT shall be 65F.
    - c. SAT shall be linear when OAT is between above conditions.
- D. Morning warmup
  - 1. When OAT is below 50F, unit shall initiate warmup cycle prior to occupancy period. Outdoor air damper shall be closed and heat shall be at 100% until occupied heating setpoints are met.
- E. Safeties
  - 1. Duct discharge pressure high limit shall disable unit and fan when pressure rises above setpoint (3.75", adjustable).
  - 2. Evaporator coil freeze stat shall disable cooling when temperature drops below 38F (adj).
  - 3. Smoke detectors shall be part of the fire alarm system and shall be hard wired through the fire alarm panel to shut the unit down upon detection of smoke.
- F. Data available at front end (via BACnet gateway from unit controllers):
  - 1. Supply air temperature
  - 2. Supply air temperature setpoint
  - 3. Supply fan speed
  - 4. Supply fan status

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- 5. Cooling percent output
- 6. Heating percent output
- 7. Outdoor air damper position
- 8. Building pressure
- 9. Building pressure setpoint
- 10. Power exhaust fan speed
- 11. Power exhaust fan status
- 12. Alarms

## 1.4 RTU-2 & 3 CONTROL SEQUENCE

- A. Supply Fan
  - 1. Occupied mode:
    - a. Fan shall run continuously.
    - b. Controls shall modulate supply fan speed from minimum to maximum in conjunction with staging compressors or gas heat to maintain space temperature setpoints. When space temperature is satisfied, supply fan shall be at minimum speed.
  - 2. Unoccupied mode:
    - a. Fan shall run intermittently to maintain unoccupied space temperature setpoints.
- B. Outdoor Air Control
  - 1. Occupied mode:
    - a. Outdoor air damper shall be open to minimum position. When space CO2 rises above setpoint (1000 ppm, adjustable), modulate outdoor air damper up to higher minimum setting to maintain space CO2 setpoint.
  - 2. Unoccupied mode:
    - a. Outdoor air damper shall be closed.
  - 3. Economizer mode:
    - a. Modulate outdoor air and return air dampers on calls for cooling to maintain leaving air temperature setpoint when outdoor conditions are acceptable.
  - 4. Building pressure control:
    - a. Modulate power exhaust fan speed to maintain slight space positive pressure setpoint (+0.03", adjustable).

- C. Temperature Control
  - 1. Controls shall stage compressors/heating and fan speed to maintain room air temperature setpoints.
    - a. Occupied cooling setpoint shall be 75°F (adj).
    - b. Occupied heating setpoint shall be 72°F (adj).
    - c. Unoccupied cooling setpoint shall be 82°F (adj).
    - d. Unoccupied heating setpoint shall be 65°F (adj).
- D. Dehumidification Control
  - 1. When space RH rises above setpoint (60% RH, adj), enable dehumidification mode. Controls shall slow fan speed, enable cooling and hot gas reheat coil to maintain space RH and space heating temperature setpoint.
- E. Safeties
  - 1. Evaporator coil freeze stat shall disable cooling when temperature drops below 38F (adj).
  - 2. Smoke detectors shall be part of the fire alarm system and shall be hard wired through the fire alarm panel to shut the unit down upon detection of smoke.
- F. Data available at front end (via BACnet gateway from unit controllers):
  - 1. Space temperature
  - 2. Space temperature setpoint
  - 3. Space relative humidity
  - 4. Space relative humidity setpoint
  - 5. Space CO2
  - 6. Space CO2 setpoint
  - 7. Supply air temperature
  - 8. Supply fan speed
  - 9. Supply fan status
  - 10. Cooling percent output
  - 11. Heating percent output
  - 12. Outdoor air damper position
  - 13. Building pressure
  - 14. Building pressure setpoint
  - 15. Power exhaust fan speed
  - 16. Power exhaust fan status
  - 17. Alarms

## 1.5 VAV BOX CONTROL

- A. When space temperature is between heating and cooling setpoints, airflow shall be at minimum speed.
- B. When space temperature is above setpoint, modulate airflow up to maximum cooling airflow setpoint to maintain space temperature.
- C. When space temperature is below heating setpoint, set airflow to maximum heating airflow setpoint and modulate electric heating coil output to maintain space temperature.
- D. For VAV box zones with supplemental electric finned tube radiation:
  - 1. When outdoor air temperature is below 50F:
    - a. First stage of heating shall be finned tube radiation. Box airflow shall be at minimum position and modulate heating coil so leaving air temperature is 72F (adj).
    - b. Second stage of heating shall be to modulate airflow to maximum heating position and modulate heating coil to maintain space temperature (finned tube radiation to remain on).
  - 2. When outdoor air temperature is above 50F, follow standard VAV box heating control.
- E. Data available at front end:
  - 1. Damper position
  - 2. Airflow
  - 3. Percent heat output
  - 4. Supply air temperature (downstream of heater)
  - 5. Space temperature
  - 6. Space temperature setpoint
  - 7. Finned tube radiation status (where applicable)

# 1.6 EXHAUST FAN CONTOL

- A. Fan shall run continuously during occupied mode, off during unoccupied mode.
- B. Data available at front end:
  - 1. Fan status
  - 2. Alarm (fan is enabled and status is off)

# 1.7 DUCTLESS SPLIT SYSTEM CONTOL

A. Unit manufacturer's wall thermostat shall enable unit fan and cooling to maintain space cooling setpoints (75F, adj).

- B. A separate BAS temperature sensor shall monitor space temperature in the MDF room only.
- C. Data available at front end (MDF room only):
  - 1. Space temperature
  - 2. Space temperature setpoint
  - 3. Alarm (space temp 5F above setpoint)

## 1.8 ELECTRIC UNIT HEATER AND CABINET UNIT HEATER CONTROL SEQUENCE

- A. Stand-alone thermostat by unit manufacturer shall control space temperature setpoint (70°F, adj).
- B. Unit controls shall be stand alone and not connected to the BAS.
- 1.9 BAS ALARMS
  - A. BAS shall generate alarms for any out-of-range condition (equipment failure, temperature outof-range, etc) for the connected HVAC equipment. Alarms shall be routed as designated by owner. Alarm levels to be determined by owner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 09 93

## SECTION 23 21 13 - HYDRONIC PIPING

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, and specialties for the following:
  - 1. Condensate Drain piping.

## 1.2 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
  - 1. Condensate Drain Piping: 140 deg F.

#### 1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

- 2.1 COPPER TUBE AND FITTINGS
  - A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
  - B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
  - C. DWV Copper Tubing: ASTM B 306, Type DWV.
  - D. Wrought-Copper Fittings: ASME B16.22.
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Anvil International, Inc.
      - b. Victaulic Company of America.

- 2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
- Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, pre-lubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.
- E. Copper or Bronze Pressure-Seal Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Viega LLC.
  - 2. Housing: Copper.
  - 3. O-Rings and Pipe Stops: EPDM.
  - 4. Tools: Manufacturer's special tools.
  - 5. Minimum 200-psig (1379-kPa) working-pressure rating at 250 deg F (121 deg C).
- F. Wrought-Copper Unions: ASME B16.22.

## 2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

## PART 3 - EXECUTION

#### 3.1 PIPING APPLICATIONS

A. Condensate-Drain Piping: Type DWV or L, drawn-temper copper tubing, wrought-copper fittings, and soldered or pressure-seal joints.

#### 3.2 PIPING INSTALLATIONS

- A. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- B. 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.
- C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- D. Install piping at indicated slopes.
- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.
- G. Install piping to allow application of insulation.
- H. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- I. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- J. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- K. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- L. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- M. Identify piping as specified in Division 23 Section "Mechanical Identification."

## 3.3 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports." Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
- E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

## 3.4 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
- H. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

# 3.5 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for piping connections shall be the same as or larger than equipment connections.

## 3.6 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water.
- B. Perform the following tests on hydronic piping:
  - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

## END OF SECTION 23 21 13

#### SECTION 23 23 00 - REFRIGERANT PIPING

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
  - 2. Hot Gas and Liquid Lines: 535 psig.

#### 1.4 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."

## 1.5 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

#### PART 2 - PRODUCTS

#### 2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type L orSTM B 280, Type ACR.

- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.

## 2.2 VALVES AND SPECIALTIES

- A. Diaphragm Pack-less Valves:
  - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
  - 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
  - 3. Operator: Rising stem and hand wheel.
  - 4. Seat: Nylon.
  - 5. End Connections: Socket, union, or flanged.
  - 6. Working Pressure Rating: 500 psig
  - 7. Maximum Operating Temperature: 275 deg F
- B. Packed-Angle Valves:
  - 1. Body and Bonnet: Forged brass or cast bronze.
  - 2. Packing: Molded stem, back seating, and replaceable under pressure.
  - 3. Operator: Rising stem.
  - 4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
  - 5. Seal Cap: Forged-brass or valox hex cap.
  - 6. End Connections: Socket, union, threaded, or flanged.
  - 7. Working Pressure Rating: 500 psig
  - 8. Maximum Operating Temperature: 275 deg F
- C. Check Valves:
  - 1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
  - 2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
  - 3. Piston: Removable polytetrafluoroethylene seat.
  - 4. Closing Spring: Stainless steel.
  - 5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
  - 6. End Connections: Socket, union, threaded, or flanged.
  - 7. Maximum Opening Pressure: 0.50 psig
  - 8. Working Pressure Rating: 500 psig
  - 9. Maximum Operating Temperature: 275 deg F

- D. Service Valves:
  - 1. Body: Forged brass with brass cap including key end to remove core.
  - 2. Core: Removable ball-type check valve with stainless-steel spring.
  - 3. Seat: Polytetrafluoroethylene.
  - 4. End Connections: Copper spring.
  - 5. Working Pressure Rating: 500 psig
- E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
  - 1. Body and Bonnet: Plated steel.
  - 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
  - 3. Seat: Polytetrafluoroethylene.
  - 4. End Connections: Threaded.
  - 5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inchconduit adapter, and 24-V ac coil.
  - 6. Working Pressure Rating: 400 psig
  - 7. Maximum Operating Temperature: 240 deg F
  - 8. Manual operator.
- F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
  - 1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
  - 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
  - 3. Seat Disc: Polytetrafluoroethylene.
  - 4. End Connections: Threaded.
  - 5. Working Pressure Rating: 400 psig
  - 6. Maximum Operating Temperature: 240 deg F
- G. Thermostatic Expansion Valves: Comply with ARI 750.
  - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
  - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  - 3. Packing and Gaskets: Non-asbestos.
  - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
  - 5. Superheat: Adjustable.
  - 6. Reverse-flow option (for heat-pump applications).
  - 7. End Connections: Socket, flare, or threaded union.
  - 8. Working Pressure Rating: 700 psig
- H. Moisture/Liquid Indicators:
  - 1. Body: Forged brass.
  - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.

- 3. Indicator: Color coded to show moisture content in ppm.
- 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
- 5. End Connections: Socket or flare.
- 6. Working Pressure Rating: 500 psig
- 7. Maximum Operating Temperature: 240 deg F
- I. Permanent Filter Dryers: Comply with ARI 730.
  - 1. Body and Cover: Painted-steel shell.
  - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
  - 3. Desiccant Media: Activated alumina.
  - 4. Designed for reverse flow (for heat-pump applications).
  - 5. End Connections: Socket.
  - 6. Access Ports: NPS 1/4connections at entering and leaving sides for pressure differential measurement.
  - 7. Maximum Pressure Loss: 2 psig
  - 8. Working Pressure Rating: 500 psig
  - 9. Maximum Operating Temperature: 240 deg F
- J. Mufflers:
  - 1. Body: Welded steel with corrosion-resistant coating.
  - 2. End Connections: Socket or flare.
  - 3. Working Pressure Rating: 500 psig
  - 4. Maximum Operating Temperature: 275 deg F
- K. Receivers: Comply with ARI 495.
  - 1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
  - 2. Comply with UL 207; listed and labeled by an NRTL.
  - 3. Body: Welded steel with corrosion-resistant coating.
  - 4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
  - 5. End Connections: Socket or threaded.
  - 6. Working Pressure Rating: 500 psig
  - 7. Maximum Operating Temperature: 275 deg F
- L. Liquid Accumulators: Comply with ARI 495.
  - 1. Body: Welded steel with corrosion-resistant coating.
  - 2. End Connections: Socket or threaded.
  - 3. Working Pressure Rating: 500 psig
  - 4. Maximum Operating Temperature: 275 deg F

# 2.3 REFRIGERANTS

- A. 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.
- B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

## PART 3 - EXECUTION

- 3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A
  - A. Suction Lines NPS 1-1/2and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
  - B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wroughtcopper fittings with brazed or soldered joints.

# 3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm pack-less valves in suction and discharge lines of compressor.
- B. Install a check valve at the compressor discharge.
- C. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- D. Install thermostatic expansion valves as close as possible to distributors on evaporators.
  - 1. Install valve so diaphragm case is warmer than bulb.
  - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
  - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- E. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- F. Install filter dryers in liquid line between compressor and thermostatic expansion valve.
# 3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

- O. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:
  - 1. Shot blast the interior of piping.
  - 2. Remove coarse particles of dirt and dust by drawing a clean, lint-less cloth through tubing by means of a wire or electrician's tape.
  - 3. Draw a clean, lint-less cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
  - 4. Draw a clean, lint-less cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
  - 5. Finally, draw a clean, dry, lint-less cloth through the tube or pipe.
  - 6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.
- R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- S. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

## 3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

#### **REFRIGERANT PIPING**

- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

## 3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feetlong.
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feetor longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feetor longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2 Maximum span, 60 inches minimum rod size, 1/4 inch
  - 2. NPS 5/8 Maximum span, 60 inches minimum rod size, 1/4 inch
  - 3. NPS 1 Maximum span, 72 inches minimum rod size, 1/4 inch
  - 4. NPS 1-1/4 Maximum span, 96 inches minimum rod size, 3/8 inch
  - 5. NPS 1-1/2 Maximum span, 96 inches minimum rod size, 3/8 inch
  - 6. NPS 2 Maximum span, 96 inches minimum rod size, 3/8 inch
  - 7. NPS 2-1/2 Maximum span, 108 inches minimum rod size, 3/8 inch
  - 8. NPS 3 Maximum span, 10 feet minimum rod size, 3/8 inch
  - 9. NPS 4 Maximum span, 12 feet minimum rod size, 1/2 inch
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 2 Maximum span, 10 feet minimum rod size, 3/8 inch
  - 2. NPS 2-1/2 Maximum span, 11 feet minimum rod size, 3/8 inch

- 3. NPS 3 Maximum span, 12 feet minimum rod size, 3/8 inch
- 4. NPS 4 Maximum span, 14 feet minimum rod size, 1/2 inch
- E. Support multi-floor vertical runs at least at each floor.

## 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
  - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    - a. Fill system with nitrogen to the required test pressure.
    - b. System shall maintain test pressure at the manifold gage throughout duration of test.
    - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

# 3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
  - 1. Install core in filter dryers after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig
  - 4. Charge system with a new filter-dryer core in charging line.

## 3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Open shutoff valves in condenser water circuit.
  - 2. Verify that compressor oil level is correct.
  - 3. Open compressor suction and discharge valves.
  - 4. Open refrigerant valves except bypass valves that are used for other purposes.
  - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 23 00

SECTION 23 31 13 - METAL DUCTS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Double-wall rectangular ducts and fittings.
  - 3. Single-wall round ducts and fittings.
  - 4. Double-wall round ducts and fittings.
  - 5. Sheet metal materials.
  - 6. Sealants and gaskets.
  - 7. Hangers and supports.
- B. Related Sections:
  - 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, ductmounting access doors and panels, turning vanes, and flexible ducts.

## 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards Metal and Flexible"
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
  - 1. Liners and adhesives.
  - 2. Sealants and gaskets.
- B. Delegated-Design Submittal:
  - 1. Sheet metal thicknesses.
  - 2. Joint and seam construction and sealing.
  - 3. Reinforcement details and spacing.
  - 4. Materials, fabrication, assembly, and spacing of hangers and supports.

## PART 2 - PRODUCTS

# 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Rectangular Ducts: Fabricate ducts with indicated dimensions for clear internal dimensions of the inner duct.

- B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
  - 1. For ducts with longest side less than 36 inches (914 mm), select joint types in accordance with Figure 2-1.
  - 2. For ducts with longest side 36 inches (914 mm) or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
- D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.
- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
  - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
  - 3. Coat insulation with antimicrobial coating.
  - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
  - 1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F (0.034 W/m x K) at 75 deg F (24 deg C) mean temperature.
- G. Inner Duct: Minimum 24-gauge (0.7-mm) solid galvanized sheet steel.

# 2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

### 2.5 DOUBLE-WALL ROUND DUCTS AND FITTINGS

- A. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
  - 1. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
    - a. Construct ducts of galvanized sheet steel unless otherwise indicated.
  - 2. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
  - 3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 4. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Inner Duct: Minimum 24-gauge (0.7-mm) [perforated galvanized sheet steel having 3/32-inch-(2.4-mm-) diameter perforations, with overall open area of 23 percent] [solid galvanized sheet steel].
- C. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
  - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
  - 3. Coat insulation with antimicrobial coating.
  - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- D. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F (0.034 W/m x K) at 75 deg F (24 deg C) mean temperature.

# 2.6 DUCT LINER

- A. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.
    - c. Rubatex International, LLC.
  - 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
  - 3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
    - a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Insulation Pins and Washers:
  - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
  - 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick aluminum or stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
  - 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
  - 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
  - 3. Butt transverse joints without gaps, and coat joint with adhesive.
  - 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure buttededge overlapping.
  - 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
  - 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).

- 7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
- 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
  - a. Fan discharges.
  - b. Intervals of lined duct preceding unlined duct.
  - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.
- 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
  - a. Sheet Metal Inner Duct Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.
- 10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

# 2.7 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
  - 1. Application Method: Brush on.
  - 2. Solids Content: Minimum 65 percent.
  - 3. Shore A Hardness: Minimum 20.
  - 4. Water resistant.
  - 5. Mold and mildew resistant.
  - 6. VOC: Maximum 75 g/L (less water).
  - 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  - 8. Service: Indoor or outdoor.
  - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Flanged Joint Sealant: Comply with ASTM C 920.
  - 1. General: Single-component, acid-curing, silicone, elastomeric.
  - 2. Type: S.
  - 3. Grade: NS.
  - 4. Class: 25.

- 5. Use: O.
- 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- E. Round Duct Joint O-Ring Seals:
  - 1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  - 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  - 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.8 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Provide gasketed-type fittings; field-applied duct sealant is not allowed.
- C. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- D. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

#### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.

- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

# 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

# 3.6 PAINTING

Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.
Paint materials and application requirements are specified in Division 09 painting Sections.

# 3.7 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

## 3.8 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except for those designated on plans and below to be aluminum.
- B. Supply Ducts:
  - 1. Ducts Connected to Terminal Units:
    - a. Pressure Class: Positive 2-inch wg.
  - 2. Exposed and Concealed Ducts Connected to Air Handling Units:
    - a. Pressure Class: Positive 4-inch wg.

- C. Return Ducts:
  - 1. Ducts Connected to air handling units:
    - a. Pressure Class: Positive or negative 2-inch wg.
- D. Exhaust Ducts:
  - 1. Ducts connected to exhaust fans:
    - a. Pressure Class: Negative 2-inch wg.
- E. Double-Wall Duct Interstitial Insulation:
  - 1. Exposed Supply-Air Ducts: 1-1/2 (38) inch(es) (mm) thick.
- F. Elbow Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Velocity 1000 fpm or Lower:
      - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      - 2) Mitered Type RE 4 without vanes.
    - b. Velocity 1000 to 1500 fpm:
      - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
    - c. Velocity 1500 fpm or Higher:
      - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-4, "Round Duct Elbows."
    - Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

- 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
- 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
- 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
- G. Branch Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-6, "Branch Connection."
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
    - b. Rectangular Main to Round Branch: Spin in.
  - 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
    - a. Velocity 1000 fpm or Lower: 90-degree tap.
    - b. Velocity 1000 or Higher: Conical tap.

END OF SECTION 23 31 13

## SECTION 23 33 00 - AIR DUCT ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Backdraft dampers.
  - 2. Volume dampers.
  - 3. Turning vanes.
  - 4. Duct-mounting access doors.
  - 5. Flexible connectors.
  - 6. Flexible ducts.
  - 7. Duct accessory hardware.

## 1.2 SUBMITTALS

- A. Product Data: For the following:
  - 1. Backdraft dampers.
  - 2. Volume dampers.
  - 3. Turning vanes.
  - 4. Duct-mounting access doors.
  - 5. Flexible connectors.
  - 6. Flexible ducts.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Special fittings.
  - 2. Manual-volume damper installations.
  - 3. Wiring Diagrams: Power, signal, and control wiring.

## 1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 SHEET METAL 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.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G Series coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Stainless Steel: ASTM A 480/A 480M.
- D. Aluminum Sheets: 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: ASTM B 221, alloy 6063, temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.3 BACKDRAFT DAMPERS

- A. Manufacturers:
  - 1. Air Balance, Inc.
  - 2. American Warming and Ventilating.
  - 3. CESCO Products.
  - 4. Duro Dyne Corp.
  - 5. Greenheck.
  - 6. Penn Ventilation Company, Inc.
  - 7. Prefco Products, Inc.

- 8. Ruskin Company.
- 9. Vent Products Company, Inc.
- B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.
- C. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners and mounting flange.
- D. Blades: 0.050-inch- thick aluminum sheet.
- E. Blade Seals: Neoprene.
- F. Blade Axles: Galvanized steel.
- G. Tie Bars and Brackets: Galvanized steel.
- H. Return Spring: Adjustable tension.

## 2.4 VOLUME DAMPERS

- A. Manufacturers:
  - 1. Air Balance, Inc.
  - 2. American Warming and Ventilating.
  - 3. Flexmaster U.S.A., Inc.
  - 4. Greenheck.
  - 5. McGill AirFlow Corporation.
  - 6. METALAIRE, Inc.
  - 7. Nailor Industries Inc.
  - 8. Penn Ventilation Company, Inc.
  - 9. Ruskin Company.
  - 10. Vent Products Company, Inc.
- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
- C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.
  - 1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064es inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.

- 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
- 3. Blade Axles: Galvanized steel.
- 4. Tie Bars and Brackets: Galvanized steel.

# 2.5 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
- B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, single-vane, curved blades of galvanized sheet steel set 3/4 inches o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Duro Dyne Corp.
    - c. METALAIRE, Inc.
    - d. Ward Industries, Inc.

# 2.6 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class.
- B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

## 2.7 FLEXIBLE DUCTS

- A. Manufacturers:
  - 1. Flexmaster U.S.A., Inc.
  - 2. Hart & Cooley, Inc.
  - 3. McGill AirFlow Corporation.
  - 4. Or approved by Engineer as equal.
- B. Insulated-Duct Connectors: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 10 to plus 160 deg F.

C. Flexible Duct Clamps: Nylon strap, in sizes 3 through 18 inches to suit duct size.

### 2.8 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

### 2.9 FLEXIBLE CONNECTORS

- A. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Materials: Flame-retardant or noncombustible fabrics.
- D. Coatings and Adhesives: Comply with UL 181, Class 1.
- E. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-), galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
  - 2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm)in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

#### PART 3 - EXECUTION

# 3.1 APPLICATION AND 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. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.
- F. Provide test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.
- H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
  - 1. On both sides of duct coils.
  - 2. Downstream from volume dampers and equipment.
  - 3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
  - 4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
  - 5. On sides of ducts where adequate clearance is available.
- I. Install the following sizes for duct-mounting, rectangular access doors:
  - 1. One-Hand or Inspection Access: 8 by 5 inches.
  - 2. Two-Hand Access: 12 by 6 inches.
  - 3. Head and Hand Access: 18 by 10 inches.
  - 4. Head and Shoulders Access: 21 by 14 inches.
  - 5. Body Access: 25 by 14 inches.
  - 6. Body Plus Ladder Access: 25 by 17 inches.
- J. Install the following sizes for duct-mounting, round access doors:
  - 1. One-Hand or Inspection Access: 8 inches in diameter.
  - 2. Two-Hand Access: 10 inches in diameter.
  - 3. Head and Hand Access: 12 inches in diameter.
  - 4. Head and Shoulders Access: 18 inches in diameter.
  - 5. Body Access: 24 inches in diameter.
- K. Label access doors according to Division 15 Section "Mechanical Identification."

- L. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- M. Connect diffusers or light troffer boots to low pressure ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- N. Connect flexible ducts to metal ducts with draw bands.
- O. Install duct test holes where indicated and required for testing and balancing purposes.

# 3.2 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION 23 33 00

# SECTION 23 34 23 - HVAC POWER VENTILATORS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Ceiling-mounted ventilators.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
  - 2. Rated capacities, operating characteristics, and furnished specialties and accessories.
  - 3. Certified fan performance curves with system operating conditions indicated.
  - 4. Certified fan sound-power ratings.
  - 5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 6. Material thickness and finishes, including color charts.
  - 7. Dampers, including housings, linkages, and operators.
  - 8. Prefabricated roof curbs.
  - 9. Fan speed controllers.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
  - 4. Design Calculations: Calculate requirements for selecting vibration isolators.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, or BIM model, drawn to scale, showing the items described in this Section and coordinated with all building trades.
- B. Field quality-control reports.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Operation and Maintenance Data: For HVAC power ventilators to include in normal and emergency operation, and maintenance manuals.

# 1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

# PART 2 - PRODUCTS

# 2.1 CEILING-MOUNTED VENTILATORS

- A. <u>Manufacturers:</u>
  - 1. <u>Acme Engineering & Manufacturing Corp</u>.
  - 2. <u>Greenheck Fan Corporation</u>.
  - 3. Loren Cook Company.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel removable for service.
- D. Back-draft damper: Integral.
- E. Grille: Plastic, louvered grille with flange on intake and thumbscrew or spring retainer attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:

- 1. Variable-Frequency Motor Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
- 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
- 3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
- 4. Motion Sensor: Motion detector with adjustable shutoff timer.
- 5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless steel springs, and fusible link.
- 6. Filter: Washable aluminum to fit between fan and grille.
- 7. Isolation: Rubber-in-shear vibration isolators.
- 8. Manufacturer's standard roof jack or wall cap, and transition fittings.

# 2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

# 2.3 SOURCE QUALITY CONTROL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. AMCA Certification: Fans shall comply with AMCA 11 and bear the AMCA-Certified Ratings Seal.
- C. Fan Sound Ratings: Comply with AMCA 311, and label fans with the AMCA-Certified Ratings Seal. Sound ratings shall comply with AMCA 301. The fans shall be tested according to AMCA 300.
- D. Fan Performance Ratings: Comply with AMCA 211 and label fans with AMCA-Certified Rating Seal. The fans shall be tested for air performance flow rate, fan pressure, power, fan efficiency, air density, speed of rotation, and fan efficiency according to AMCA 210/ASHRAE 51.
- E. Operating Limits: Classify according to AMCA 99.
- F. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

## PART 3 - EXECUTION

# 3.1 INSTALLATION OF HVAC POWER VENTILATORS

- A. Install power ventilators level and plumb.
- B. Equipment Mounting:
  - 1. Install power ventilators on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
  - 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
  - 3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

# 3.2 DUCTWORK CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

## 3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
  - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
  - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch (13 mm) high.

## 3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

## 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that there is adequate maintenance and access space.
  - 4. Verify that cleaning and adjusting are complete.
  - 5. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 6. Adjust belt tension.
  - 7. Adjust damper linkages for proper damper operation.
  - 8. Verify lubrication for bearings and other moving parts.
  - 9. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 10. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 11. Shut unit down and reconnect automatic temperature-control operators.
  - 12. Remove and replace malfunctioning units and retest as specified above.
- F. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports.

## 3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.

END OF SECTION 23 34 23

# SECTION 23 36 00 – AIR TERMINAL UNITS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Single-duct air terminal units.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.
  - 1. Air terminal units.
  - 2. Liners and adhesives.
  - 3. Sealants and gaskets.

## 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  - 1. Instructions for resetting minimum and maximum air volumes.

## 1.5 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: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-Up."

## PART 2 - PRODUCTS

## 2.1 SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carrier.
  - 2. Johnson Controls.
  - 3. Krueger.
  - 4. Metal-Aire.
  - 5. Nailor Industries Inc.
  - 6. Price Industries.
  - 7. Titus.
  - 8. Trane.
- B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.
- C. Casing: 0.034-inch steel, single wall.
  - 1. Casing Lining: Adhesive attached, 1/2-inch-thick, closed cell elastomeric insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
  - 2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
  - 3. Air Outlet: S-slip and drive connections.
  - 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
  - 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Regulator Assembly: System-air-powered bellows section incorporating polypropylene bellows for volume regulation and thermostatic control. Bellows shall operate at temperatures from 0 to 140 deg F, shall be impervious to moisture and fungus, shall be suitable for 10-inch wg static pressure, and shall be factory tested for leaks.
- E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
  - 1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
- F. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.

- 1. SCR controlled.
- 2. Airflow switch for proof of airflow.
- 3. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
- G. Provide controls enclosure for factory-mounted actuator and controller. Controls provided by temperature control provider, installed at factory.

## 2.2 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- C. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

# 2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test assembled air terminal units according to ARI 880.
  - 1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, and ARI certification seal.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

# 3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.

- 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
- 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
- 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

# 3.3 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

# 3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Air terminal unit will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

## 3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 23 36 00
SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

#### PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Adjustable face grilles.

#### 1.2 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.

#### PART 2 - PRODUCTS

## 2.1 REGISTERS AND GRILLES

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Krueger.
  - b. Carnes
  - c. Price Industries.
  - d. Titus.
- 2. Material: Steel or aluminum, as noted on schedule.
- 3. Finish: Baked enamel or as noted on schedule.

## 2.2 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 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.

## 3.2 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

# SECTION 23 74 13 – PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNIT

#### 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 packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
  - 1. Direct-expansion cooling.
  - 2. Gas furnace.
  - 3. Economizer outdoor- and return-air damper section.
  - 4. Integral, space temperature controls.
  - 5. Roof curbs.

#### 1.3 DEFINITIONS

- A. DDC: Direct-digital controls.
- B. ECM: Electrically commutated motor.
- C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
- F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

## 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design RTU supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Wind-Restraint Performance:
  - 1. Basic Wind Speed: 90 MPH
  - 2. Minimum 10 lb/sq. ft (48.8 kg/sq. m) multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

## 1.5 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
  - 2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
  - 3. Wind-Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
- D. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Structural members to which RTUs will be attached.
  - 2. Roof openings

- 3. Roof curbs and flashing.
- E. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Field quality-control test reports.
- G. Warranty: Special warranty specified in this Section.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fan Belts: One set for each belt-driven fan.
  - 2. Filters: One set of filters for each unit.

## 1.8 QUALITY ASSURANCE

- A. ARI Compliance:
  - 1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
  - 2. Comply with ARI 270 for testing and rating sound performance for RTUs.
- B. ASHRAE Compliance:
  - 1. Comply with ASHRAE 15 for refrigeration system safety.
  - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
  - 3. Comply with applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."

- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 -"Heating, Ventilating, and Air-Conditioning."
- D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
- E. UL Compliance: Comply with UL 1995.
- F. 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.

# 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
  - 2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
  - 3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
  - 4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide a product by one of the following:
  - 1. AAON, Inc.
  - 2. Carrier Corporation.
  - 3. Trane; American Standard Companies, Inc.
  - 4. YORK International Corporation.

## 2.2 CASING

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

- B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
- C. Inner Casing Material: Galvanized steel.
- D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
  - 1. Materials: ASTM C 1071, Type I.
  - 2. Thickness: 2 inch
  - 3. Double wall construction with sheetmetal internal liner.
  - 4. Liner Adhesive: Comply with ASTM C 916, Type I.
- E. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches (50 mm) deep and complying with ASHRAE 62.1.
  - 1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
  - 2. Drain Connections: Threaded nipple.
- F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- 2.3 FANS
  - A. Direct-Driven and Belt Driven Supply-Air Fans: Single width, backward inclined or airfoil centrifugal; with permanently lubricated, VFD motor resiliently mounted. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls. Refer to schedules for fan type.
    - 1. Mount fans on restrained spring isolators with a minimum of 1-inch static deflection.
  - B. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.
  - C. Relief-Air Fan: Backward inclined or airfoil, shaft mounted on permanently lubricated motor.
    - 1. Mount fans on restrained spring isolators with a minimum of 1-inch static deflection.
  - D. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
- 2.4 COILS
  - A. Supply-Air Refrigerant Coil:
    - 1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

- 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
- 3. Coil Split: Interlaced.
- 4. Condensate Drain Pan: Stainless steel formed with pitch and drain connections complying with ASHRAE 62.1.
- B. Outdoor-Air Refrigerant Coil:
  - 1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
  - 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.

# 2.5 REFRIGERANT CIRCUIT COMPONENTS

- A. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.
  - 1. Variable Capacity Control: Provide digital scroll or variable speed compressor.
  - 2. Mount compressors on neoprene isolators or spring isolators.
- B. Refrigeration Specialties:
  - 1. Refrigerant: R-410A.
  - 2. Expansion valve with replaceable thermostatic element.
  - 3. Refrigerant filter/dryer.
  - 4. Manual-reset high-pressure safety switch.
  - 5. Automatic-reset low-pressure safety switch.
  - 6. Minimum off-time relay.
  - 7. Automatic-reset compressor motor thermal overload.
  - 8. Brass service valves installed in compressor suction and liquid lines.
  - 9. Low-ambient kit high-pressure sensor.
  - 10. Hot-gas reheat solenoid valve with a replaceable magnetic coil.
  - 11. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
  - 12. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

# 2.6 AIR FILTRATION

- A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
  - 1. Pleated: Minimum MERV 13.

## 2.7 GAS FURNACE

- A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.
  - 1. CSA Approval: Designed and certified by and bearing label of CSA.
- B. Burners: Stainless steel.
  - 1. Fuel: Natural gas.
  - 2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
- C. Heat-Exchanger and Drain Pan: Stainless steel.
- D. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve with vertical extension.
- E. Safety Controls:
  - 1. Gas Control Valve: Modulating.
  - 2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

## 2.8 DAMPERS

- A. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
  - 1. Damper Motor: Modulating with adjustable minimum position.
  - 2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

# 2.9 ELECTRICAL POWER CONNECTION

- A. Provide for single connection of power to unit with control-circuit transformer with built-in overcurrent protection.
- 2.10 CONTROLS
  - A. Control equipment and sequence of operation are specified in Division 23 Section "Instrumentation and Control for HVAC." Refer to Temperature Control Schematics for Sequence of Operation Required.
  - B. DDC Controller:

- 1. Controller shall have volatile-memory backup.
- 2. Safety Control Operation:
  - a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
  - b. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Division 28 Section "Fire Detection and Alarm."
  - c. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F (4 deg C).
  - d. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
- 3. Scheduled Operation: Occupied and unoccupied periods on 365-day clock with a minimum of four programmable periods per day.
- 4. Refrigerant Circuit Operation:
  - a. Cycle or stage compressors to match compressor output to cooling load to maintain discharge temperature setpoint. Cycle condenser fans to maintain maximum hot-gas pressure. Refrigerant coil may be cooling or heating with air-to-air heat pump. Retain second option in first subparagraph below for air-to-air heat pumps.
  - b. Provide and control all safeties.
- 5. Gas Furnace Operation:
  - a. Modulate burner to maintain discharge temperature setpoint.
  - b. Provide and control all safeties.
- 6. Economizer Outdoor-Air Damper Operation:
  - a. Open to fixed minimum intake, and maximum 100 percent of the fan capacity to comply with ASHRAE 90.1 and sequence of operation.
  - b. Outdoor-Airflow Monitor: Accuracy maximum plus or minus 5 percent within 15 and 100 percent of total outdoor air. Monitor microprocessor shall adjust for temperature, and output shall range from 4 to 20 mA or 0 to 10 V. Coordinate signal with Temperature Control Contractor.
- C. Interface Requirements for HVAC Instrumentation and Control System:
  - 1. Interface relay for scheduled operation.
  - 2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
  - 3. Provide BACnet compatible interface for central HVAC control workstation for the following:
    - a. Adjusting set points.
    - b. Monitoring supply fan start, stop, and operation.

- c. Inquiring data to include outdoor-air damper position,] supply- and room-air temperature and humidity.
- d. Monitoring occupied and unoccupied operations.
- e. Monitoring constant and variable motor loads.
- f. Monitoring variable-frequency drive operation.
- g. Monitoring cooling load.
- h. Monitoring economizer cycles.
- i. Monitoring air-distribution static pressure and ventilation air volume.

## 2.11 ACCESSORIES

- A. Electric heater with integral thermostat maintains minimum 50 deg F (10 deg C) temperature in gas burner compartment.
- B. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.
- C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
- D. Coil guards of painted, galvanized-steel wire.
- E. Hail guards of galvanized steel painted to match casing.
- F. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.

# 2.12 ROOF CURBS

- A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factoryinstalled wood nailer; complying with NRCA standards.
  - 1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
    - a. Materials: ASTM C 1071, Type I or II.
    - b. Thickness: 2 inches (50 mm).
  - 2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
    - a. Liner Adhesive: Comply with ASTM C 916, Type I.
    - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner

when applied as recommended by manufacturer and without causing leakage in cabinet.

- c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
- d. Liner Adhesive: Comply with ASTM C 916, Type I.
- C. Curb Height: 24 inches (610 mm).
- D. Wind and Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Division 23 Section "Vibration Controls for HVAC Piping and Equipment" for wind-load requirements.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

- A. Roof Curb: Install on roof structure, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." And ARI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing.
- B. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
- C. Install wind restraints according to manufacturer's written instructions.

# 3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to roof.

- B. Install piping adjacent to RTUs to allow service and maintenance.
  - 1. Gas Piping: Comply with applicable requirements in Division 23 Section "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
  - 1. Install ducts to termination at top of roof curb.
  - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
  - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
  - 4. Install return-air duct continuously through roof structure.

## 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. Tests and Inspections:
  - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
  - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

## 3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
  - 1. Inspect for visible damage to unit casing.
  - 2. Inspect for visible damage to furnace combustion chamber.
  - 3. Inspect for visible damage to compressor, coils, and fans.
  - 4. Inspect internal insulation.
  - 5. Verify that labels are clearly visible.
  - 6. Verify that clearances have been provided for servicing.
  - 7. Verify that controls are connected and operable.
  - 8. Verify that filters are installed.
  - 9. Clean condenser coil and inspect for construction debris.
  - 10. Clean furnace flue and inspect for construction debris.
  - 11. Connect and purge gas line.
  - 12. Remove packing from vibration isolators.
  - 13. Inspect operation of barometric relief dampers.
  - 14. Verify lubrication on fan and motor bearings.
  - 15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
  - 16. Adjust fan belts to proper alignment and tension.
  - 17. Start unit according to manufacturer's written instructions.
    - a. Start refrigeration system.
    - b. Do not operate below recommended low-ambient temperature.
    - c. Complete startup sheets and attach copy with Contractor's startup report.
  - 18. Inspect and record performance of interlocks and protective devices; verify sequences.
  - 19. Operate unit for an initial period as recommended or required by manufacturer.
  - 20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.
    - a. Measure gas pressure on manifold.
    - b. Inspect operation of power vents.
    - c. Measure combustion-air temperature at inlet to combustion chamber.
    - d. Measure flue-gas temperature at furnace discharge.
    - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
  - 21. Calibrate thermostats.
  - 22. Adjust and inspect high-temperature limits.
  - 23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
  - 24. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:
    - a. Coil leaving-air, dry- and wet-bulb temperatures.

- b. Coil entering-air, dry- and wet-bulb temperatures.
- c. Outdoor-air, dry-bulb temperature.
- d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
- 25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
- 26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
  - a. Supply-air volume.
  - b. Return-air volume.
  - c. Relief-air volume.
  - d. Outdoor-air intake volume.
- 27. Simulate maximum cooling demand and inspect the following:
  - a. Compressor refrigerant suction and hot-gas pressures.
  - b. Short circuiting of air through condenser coil or from condenser fans to outdoorair intake.
- 28. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
  - a. High-temperature limit on gas-fired heat exchanger.
  - b. Low-temperature safety operation.
  - c. Filter high-pressure differential alarm.
  - d. Economizer to minimum outdoor-air changeover.
  - e. Relief-air fan operation.
  - f. Smoke and firestat alarms.
- 29. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

## 3.6 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and airdistribution systems, clean filter housings and install new filters.

# 3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 74 13

## SECTION 23 81 26.1 - 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 split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: One set for each unit.

## 1.7 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."
  - ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 -"Construction and System Start-up."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

## 1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchorbolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. For Compressor: Five years from date of Substantial Completion.
    - b. For Parts: One year from date of Substantial Completion.
    - c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Carrier
- B. LG
- C. Mitsubishi
- D. Sanvo
- E. Trane
- F. York

# 2.2 INDOOR UNITS (5 TONS (18 kW) OR LESS)

- A. Wall-Mounted, Evaporator-Fan Components:
  - 1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
  - 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermalexpansion valve. Comply with ARI 206/110.
  - 3. Fan: Direct drive, centrifugal.
  - 4. Fan Motors:
    - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    - b. Multi-tapped, multispeed with internal thermal protection and permanent lubrication.
    - c. Enclosure Type: Totally enclosed, fan cooled.
    - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
    - e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
  - 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
  - 6. Condensate Drain Pans:
    - a. Fabricated with two percent 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
      - 2) Depth: A minimum of 1 inch (25 mm) deep.
    - b. Single-wall, stainless-steel sheet.

- c. Double-wall, stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
- d. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.
  - 1) Minimum Connection Size: NPS 1 (DN 25)
- e. Pan-Top Surface Coating: Asphaltic waterproofing compound.
- 7. Air Filtration Section:
  - a. General Requirements for Air Filtration Section:
    - 1) Comply with NFPA 90A.
    - 2) Minimum MERV according to ASHRAE 52.2.
    - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
  - b. Disposable Panel Filters:
    - 1) Factory-fabricated, viscous-coated, flat-panel type.
    - 2) Thickness: 1 inch (25 mm)
    - 3) MERV according to ASHRAE 52.2: 7
    - 4) Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
    - 5) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

# 2.3 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

- 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. Refrigerant: R-410A
    - c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid sub-cooler. Comply with ARI 206/110.
  - 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 -10 deg F.
- 6. Mounting Base: Polyethylene.

## 2.4 ACCESSORIES

- A. Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."
- B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- C. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
  - 1. Compressor time delay.
  - 2. 24-hour time control of system stop and start.
  - 3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
  - 4. Fan-speed selection including auto setting.
- D. Automatic-reset timer to prevent rapid cycling of compressor.
- E. 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.
- F. Drain Hose: For condensate.
- G. Monitoring:
  - 1. Monitor constant and variable motor loads.
  - 2. Monitor variable-frequency-drive operation.
  - 3. Monitor economizer cycle.
  - 4. Monitor cooling load.
  - 5. Monitor air distribution static pressure and ventilation air volumes.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

- C. Install roof-mounted, compressor-condenser components on equipment supports specified in Architectural drawings. Anchor units to supports with removable, cadmium-plated fasteners.
- D. Equipment Mounting:
  - 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
  - 2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

## 3.2 CONNECTIONS

A. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

# 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. 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.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

## 3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

## 3.5 DEMONSTRATION

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

END OF SECTION 23 81 26.1

## SECTION 23 82 33 - CONVECTORS

#### 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 the following:
  - 1. Electric baseboard radiators.

#### 1.3 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Plans, elevations, sections, and details.
  - 2. Details of custom-fabricated enclosures indicating dimensions.
  - 3. Location and size of each field connection.
  - 4. Location and arrangement of piping valves and specialties.
  - 5. Location and arrangement of integral controls.
  - 6. Enclosure joints, corner pieces, access doors, and other accessories.
  - 7. Wiring Diagrams: Power, signal, and control wiring.
- C. Color Samples for Initial Selection: For units with factory-applied color finishes.
- D. Color Samples for Verification: For each type of exposed finish required.
- E. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Structural members, including wall construction, to which convection units will be attached.

- 2. Method of attaching convection units to building structure.
- 3. Penetrations of fire-rated wall and floor assemblies.
- F. Field quality-control test reports.

#### 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For convection heating units to include in emergency, operation, and maintenance manuals.

#### 1.5 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.

## PART 2 - PRODUCTS

#### 2.1 ELECTRIC BASEBOARD RADIATORS

- 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. Chromalox; a division of Emerson Electric Company.
  - 2. Indeeco.
  - 3. Markel Products; a division of Marley Engineered Products.
  - 4. Marley Electric Heating; a division of Marley Engineered Products.
  - 5. Qmark Electric Heating; a division of Marley Engineered Products.
  - 6. Trane
  - 7. Vulcan
- B. Description: Factory-packaged units constructed according to UL 499, UL 1030, and UL 2021.
- C. Heating Elements: Nickel-chromium-wire heating element enclosed in metallic sheath mechanically bonded to fins, with high-temperature cutout and sensor running the full length of the element. Element supports shall eliminate thermal expansion noise.
- D. Rust-Resistant Enclosures: Minimum 12 gauge extruded aluminum.
  - 1. Full-height back.
  - 2. End panel.
  - 3. End caps.
  - 4. Inside and outside corners.

- 5. Joiner pieces to snap together.
- 6. Enclosure Height: 6"
- 7. Enclosure Depth: 3"
- 8. Finish: Anodized aluminum to match window mullions.
- E. Unit Controls: Low voltage relay for Building Management System.
- F. Accessories:
  - 1. Filler sections without a heating element matching the adjacent enclosure.
  - 2. Straight-blade-type receptacles complying with DSCC W-C-596G/GEN, NEMA WD 1, NEMA WD 6, and UL 498; in color selected by Architect.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas to receive convection heating units for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for electrical connections to verify actual locations before convection heating unit installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 BASEBOARD RADIATOR INSTALLATION

- A. Install units level and plumb.
- B. Install enclosure continuously around corners, using outside and inside corner fittings.
- C. Join sections with splice plates and filler pieces to provide continuous enclosure.
- D. Install enclosure continuously from wall to wall.
- E. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.
- F. Install valves within reach of access door provided in enclosure.
- G. Install air-seal gasket between wall and recessing flanges or front cover of fully recessed unit.
- H. Install piping within pedestals for freestanding units.

### 3.3 CONNECTIONS

- A. Ground electric convection heating units according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- 3.4 FIELD QUALITY CONTROL
  - A. Perform the following field tests and inspections and prepare test reports:
    - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper convection heating unit operation.
    - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - B. Remove and replace convection heating units that do not pass tests and inspections and retest as specified above.

END OF SECTION 23 82 33

SECTION 23 82 39 - UNIT HEATERS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Wall heaters with electric-resistance heating coils.

#### 1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. CWP: Cold working pressure.
- C. PTFE: Polytetrafluoroethylene plastic.
- D. TFE: Tetrafluoroethylene plastic.

#### 1.4 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

# 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

#### 1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."
- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 "Heating, Ventilating, and Air-Conditioning."

## PART 2 - PRODUCTS

## 2.1 WALL HEATERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Indeeco
  - 2. Q-Mark.
  - 3. Trane
- B. Description: An assembly including chassis, coil, fan, motor and controls.
- C. Comply with UL 2021.
- D. Cabinet: Removable panel for maintenance access to controls.
- E. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and tested before shipping.
- F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- G. Electric-Resistance Heating Elements: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals with stainless-steel hardware, and limit controls for high-temperature protection.
- H. Fan: Propeller type with aluminum wheel directly mounted on motor shaft.
- I. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
  - 1. Motor Type: Permanently lubricated.

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for electrical connections to verify actual locations before unit heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

A. Install unit heaters level and plumb.

#### 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

#### 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
  - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

## 3.5 ADJUSTING

A. Adjust initial temperature set points.

# 3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

END OF SECTION 23 82 39

## SECTION 23 82 39.13 - CABINET UNIT HEATERS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes cabinet unit heaters with centrifugal fans and electric-resistance heating coils.
- 1.3 DEFINITIONS
  - A. DDC: Direct digital control.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

#### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Cabinet Unit-Heater Filters: Furnish one spare filter(s) for each filter installed.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
  - A. INDEECO
  - B. Marley
  - C. QMark
  - D. Trane

#### 2.2 DESCRIPTION

- A. Factory-assembled and -tested unit complying with AHRI 440.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 2021.

## 2.3 PERFORMANCE REQUIREMENTS

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."
- B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 "Heating, Ventilating, and Air-Conditioning."

## 2.4 COIL SECTION INSULATION

- A. Insulation Materials: ASTM C1071; surfaces exposed to airstream shall have aluminum-foil facing to prevent erosion of glass fibers.
  - 1. Thickness: 1 inch (25 mm).
  - 2. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F (0.037 W/m x K at 24 deg C) mean temperature.
  - 3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84.
  - 4. Adhesive: Comply with ASTM C916 and with NFPA 90A or NFPA 90B.
  - 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

- B. Insulation Materials: Comply with NFPA 90A or NFPA 90B. Unicellular polyethylene thermal plastic, preformed sheet insulation complying with ASTM C534, Type II, except for density.
  - 1. Thickness: 1/2 inch (13 mm).
  - 2. Thermal Conductivity (k-Value): 0.24 Btu x in./h x sq. ft. at 75 deg F (0.034 W/m x K at 24 deg C) mean temperature.
  - 3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C411.
  - 4. Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
  - 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

## 2.5 CABINETS

- A. Material: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect.
  - 1. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0677-inch- (1.7-mm-) thick galvanized sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
  - 2. Recessed Flanges: Steel, finished to match cabinet.
  - 3. Control Access Door: Key operated.
  - 4. Base: Minimum 0.0528-inch- (1.35-mm-) thick steel, finished to match cabinet, 4 inches (100 mm) high with leveling bolts.

## 2.6 FILTERS

- A. Minimum Efficiency Reporting Value and Average Arrestance: According to ASHRAE 52.2.
- B. Minimum Efficiency Reporting Value: According to ASHRAE 52.2.
- C. Material: Pleated cotton-polyester media, MERV 7.

## 2.7 COILS

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.

## 2.8 CONTROLS

- A. Fan and Motor Board: Removable.
  - 1. Fan: Forward curved, double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.
  - 2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - 3. Wiring Terminations: Connect motor to chassis wiring with plug connection.
- B. Control devices and operational sequences are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."
- C. Basic Unit Controls:
  - 1. Control voltage transformer.
  - 2. Wall-mounted thermostat with the following features:
    - a. Heat-off switch.
    - b. Fan on-auto switch.
    - c. Manual fan-speed switch.
    - d. Adjustable deadband.
    - e. Exposed set point.
    - f. Exposed indication.
    - g. Deg F (Deg C) indication.
  - 3. Unit-mounted temperature sensor.
  - 4. Unoccupied period override push button.
  - 5. Data entry and access port.
    - a. Input data includes room temperature and occupied and unoccupied periods.
    - b. Output data includes room temperature, supply-air temperature, entering-water temperature, operating mode, and status.
- D. DDC Terminal Controller:
  - 1. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
  - 2. Unoccupied Period Override: Two hours.
  - 3. Unit Supply-Air Fan Operations:
    - a. Occupied Periods: Fan runs continuously.
    - b. Unoccupied Periods: Fan cycles to maintain setback room temperature.

- 4. Heating-Coil Operations:
  - a. Occupied Periods: Energize electric-resistance coil to provide heating if room temperature falls below thermostat set point.
  - b. Unoccupied Periods: Start fan and energize electric-resistance coil if room temperature falls below setback temperature.
- 5. Controller shall have volatile-memory backup.
- E. Interface with DDC System for HVAC Requirements:
  - 1. Interface relay for scheduled operation.
  - 2. Interface relay to provide indication of fault at central workstation.
  - 3. Interface shall be Allerton compatible for central DDC system for HVAC workstation and include the following functions:
    - a. Adjust set points.
    - b. Cabinet unit-heater start, stop, and operating status.
    - c. Data inquiry, including supply-air and room-air temperature.
    - d. Occupied and unoccupied schedules.
- F. Electrical Connection: Factory-wired motors and controls for a single field connection.

# 2.9 CAPACITIES AND CHARACTERISTICS

A. See Mechanical Schedules.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

A. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."
- B. Install cabinet unit heaters to comply with NFPA 90A.
- C. Suspend cabinet unit heaters from structure with elastomeric hangers. Vibration isolators are specified in Section 230548.13 "Vibration Controls for HVAC."
- D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
- E. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

# 3.3 CONNECTIONS

- A. Comply with safety requirements in UL 1995.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

# 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
  - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

# 3.5 ADJUSTING

A. Adjust initial temperature set points.

# 3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

END OF SECTION 23 82 39.13

# DIVISION 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. This Section includes the following:
  - 1. Electrical equipment coordination and installation.
  - 2. Sleeves for raceways and cables.
  - 3. Sleeve seals.
  - 4. Common electrical installation requirements.

#### 1.3 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

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

#### 1.5 QUALITY ASSURANCE

- Electrical components, devices and accessories shall be 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. All installations shall comply with NFPA 70.
- C. Include in the work, as a part of the Bid Proposal all labor, materials, services, apparatus as required to complete the intended work shown on the drawings. All equipment and systems shall be complete and operational.

D. Work for project must be performed in accordance with Federal, State and Local laws, ordinances, Codes, Rules and Regulations pertaining to the work shown.

# 1.6 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 Section "Access Doors and Frames."
- D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

# 2.2 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.138-inch thickness as indicated and of length to suit application.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems." Division 16 contractor shall provide all firestopping in accordance with division 7 requirements.

# 2.3 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 4. 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 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 raceways and 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. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."
- C. 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.
- D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- E. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- F. 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.
- G. Cut sleeves to length for mounting flush with both surfaces of walls.
- H. Extend sleeves installed in floors 2 inches above finished floor level.
- I. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
- J. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- K. 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. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- L. 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 Division 7 Section "Through-Penetration Firestop Systems." Division 16 contractor shall be responsible for all firestopping associated with his work.
- M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

- N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- O. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

# 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, 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 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 Division 7 Section "Through-Penetration Firestop Systems."

# 3.5 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

END OF SECTION 26 05 00

# SECTION 26 05 10 - ELECTRICAL TESTING

#### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes general requirements for electrical field testing and inspecting. Detailed requirements are specified in each Section containing components that require testing. General requirements include the following:
  - 1. Qualifications of testing agencies and their personnel.
  - 2. Suitability of test equipment.
  - 3. Calibration of test instruments.
  - 4. Coordination requirements for testing and inspecting.
  - 5. Reporting requirements for testing and inspecting.

#### 1.03 QUALITY ASSURANCE

- A. Testing Agency Qualifications: As specified in each Section containing electrical testing requirements and in subparagraph and associated subparagraph below.
- B. ANSI (American National Standards Institute):
  - 1. ANSI/IEEE 95.
  - 2. ANSI/IEEE 400.
  - 3. ANSI/IEEE C57.12.11.
- C. IEEE (Institute of Electrical and Electronic Engineers):
  - 1. IEEE 48.
  - 2. IEEE 81 Recommended Guide for Measuring Ground Resistance and Potential Gradients in the Earth
  - 3. IEEE 141.
- D. NEMA (National Electrical Manufacturers Association).
- E. NETA (National Electrical Testing Association).
  - 1. Test Equipment Suitability: Comply with NETA ATS, Section 5.2.
  - 2. Test Equipment Calibration: Comply with NETA ATS, Section 5.3.

3. NETA 1.001 Standards for Acceptance Testing of Electrical Distribution Apparatus

# PART 2 - NOT USED

# PART 3 - EXECUTION

# 3.01 GENERAL TESTS AND INSPECTIONS

- A. This specification provides guidelines for the inspection, testing, and checkout of the electrical system to ensure that the electrical installation is in accordance with the design specifications, drawings and manufacturers' instructions.
- B. The listings and descriptions of the inspections, tests and checks described herein shall not be considered an all inclusive. Additional normal standard construction (and sometimes repetitive) checks and tests may be necessary throughout the job.
- C. Inspections and test work shall be coordinated with the Owner/Architect/Engineer representative. Reasonable notice shall be given to Owner/Architect/Engineer to allow witnessing for those tests designated to be witnessed.
- D. Where indicated, the tests shall be performed by an independent testing agency with the following qualifications:
  - 1. Testing firm shall be corporately and financially independent testing organizations which can function as an unbiased testing authority, professionally independent of the manufacturer, supplier, and installer of equipment or system evaluated by the testing firm.
  - 2. Testing firm shall be regularly engaged in testing of electrical equipment, devices, installations and systems.
  - 3. Testing laboratory shall meet Federal Occupational Safety and Health Administration (OSHA) requirements for accreditation of independent testing laboratories, Title 29, part 1907.
  - 4. Lead, on-site technical person shall be currently certified by the National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.
  - 5. Testing firm shall use technicians who are regularly employed by firm for testing services.
  - 6. Testing firm shall submit proof of above qualifications with reports and bid documents when requested.

- E. If a group of tests are specified to be performed by an independent testing agency, prepare systems, equipment, and components for tests and inspections, and perform preliminary tests to ensure that systems, equipment, and components are ready for independent agency testing. Include the following minimum preparations as appropriate:
  - 1. Perform insulation-resistance tests.
  - 2. Perform continuity tests.
  - 3. Perform rotation test (for motors to be tested).
  - 4. Provide a stable source of single-phase, 208/120-V electrical power for test instrumentation at each test location.
- F. Equipment and circuitry shall not be energized, de-energized, or tied-in to a system without prior review and approval or the test plan and procedure by the site electrical superintendent and the owner's representative.
- G. The checks and tests shall be documented on Quality Control Forms or similar forms approved for the project.
- H. The Electrical Contractor Project Manager shall be responsible for all inspection and test activities. The detail implementation plan must be reviewed and approved by the Engineer of Record.
- I. Inspector and test technicians shall be qualified for the work by virtue of training and experience.
- 3.02 TESTING AND INSPECTION OF EQUIPEMENT AND CABLE
  - A. Preparation:
    - 1. A detailed plan and schedule shall be prepared for inspection and testing activities.
    - 2. The testing and checkout of important electrical equipment such as switchgear, substations, drive equipment, motor load/control centers, and generators may require notification of the proposed checks to the equipment manufacturer's representative.
      - a. It is important that equipment warranties or guarantees shall not be voided by testing and checkout work.
      - b. The checks and tests shall normally be supplemental to and compatible with the manufactures' instruction leaflets or literature.
      - c. Where deviations are apparent, the manufacturers' review shall be obtained before testing.
      - d. Reasonable cooperation shall be extended to permit witnessing by the manufacturer's representative if so required.
      - e. Where any questionable repairs, modifications, significant adjustments, tests, or checks are to be made, the test supervisor shall contact the electrical superintendent to determine if the work should be performed by or with the manufacturer's representative.

- f. Serial and model number of the instruments used, along with the last calibration date, shall be recorded on the test form.
- 3. Testing and checkout work shall be performed with fully qualified personnel skilled in the particular test being conducted. This is essential for obtaining and properly evaluating data while the tests are in progress, and that important facts and questionable data are reported.
- 4. The test supervisor shall insure that testing and checkout work is conducted in a safe manner. Special safety precautions such as the following shall be utilized:
  - a. Locking and tagging procedures
  - b. Barricades
  - c. De-energization or isolation of equipment before testing
  - d. Review of procedures with safety personnel
  - e. Erection of warning signs
  - f. Stationing of guards or watchmen
  - g. Maintenance of voice communications
  - h. Personnel orientation
- 5. The test apparatus shall be of the proper voltage class and rating for the test being performed. Care shall be taken that the installation shall not be overstressed
- 6. Initial resistance and low voltage tests of equipment shall be made with the equipment de-energized and with all electrical connections to the devices disconnected and locked out as required.
- 7. If resistance measurements on devices meet requirements, testing may proceed. Any short or ground shall be repaired, replaced, dried out or otherwise corrected before the circuit is energized.
- 8. Full voltage tests on circuits and equipment shall be performed only upon Electrical Contractor Project Manager Representative's approval. Electrical Contractor Project Managers representative shall be present and witness full voltage tests. The manufacturer's representative may also witness full voltage tests.
- 9. At any stage of construction, and when observed, electrical equipment or systems determined to be damaged, faulty, or requiring repairs shall be reported to the Electrical Contractor Project Managers representative. Corrective action may require prior approval
- B. Specific Equipment Tests.
- C. Electrical tests of the following specific equipment shall include all tests required by NETA, unless noted otherwise herein. These tests are briefly described below.
  - 1. Circuit Breakers by Testing Agency:
    - a. Check removable circuit breaker elements making sure aliments are true. Retighten loose bolts.
    - b. Place the drawout circuit breaker elements for each unit in its

compartment.

- c. Rack in and out breaker element and observe the 3 breaker element positions: In, Out, and In Between. Check to make sure that the breaker element shall be held rigidly in the "In" (operating) position without locking bolts.
- d. Manually operate each circuit breaker and make sure that the mechanism operates freely and without binding.
- e. Test the automatic circuit breaker trip. This shall be accomplished manually with power to the switchboard off.
- 2. Functionally and operationally test all devices, equipment and circuitry. by Electrical Contractor.
- 3. Physically and functionally check all key, electrical, mechanical or other interlock system. by Electrical Contractor.
- 4. Relay Panels and Operator Control Panels optional by Electrical Contractor or Testing Agency:
  - a. Visually inspect the panel for any apparent damage or loose connections.
  - b. Make wiring continuity tests of panel devises to respective remote
  - c. circuit breakers or other devices.
  - Verify actual alarm points on the alarm panel by simulating a fault at the actual source. Test the protective relays following the procedure above in 3.2 B.
  - e. Verify and tests all remote meter and relay devices, potential transformers, and current transformers not otherwise tested using procedures described herein.
  - f. Check mid and full scale reading of panel meters by know current or voltages.
  - g. Test the power factor and kilowatt hour demand meters for accuracy according to the manufacturer's recommendations.
  - h. Attach a test sticker on each relay, meter, PT, CT, and annunciator pane that has been tested to verify proper testing. Each sticker shall indicate name of tester and test date.
  - i. Functionally test each control circuit for proper operation and conformance with the drawings.
  - j. After tests have been made, the Electrical Contractor shall verify that all power and control wiring have been connected or reconnected to its respective connection points, and that the system is ready for energization and operation.
  - k. Seal each relay, watt-hour meter, power factor meter, and similar device with an appropriate tamperproof wire meter seal.
- 5. Batteries and Chargers by Electrical Contractor:
  - a. Visually inspect batteries and charger for physical damage and conformance with design specifications and Manufacturer's recommended installation procedures.

- b. Take specific gravity and temperature readings.
- c. Verify charging equipment operation by measuring charging current and voltage using Manufacturer's recommended procedure.
- d. Record temperature, electrolyte level, charging rate, specific gravity, and individual battery cell voltages. Check all alarms.
- 6. Grounding System by Testing Agency:
  - a. Test main building loop and major equipment grounds to remote earth or directly referenced to an extremely low resistance (approx. 1 ohm) reference ground benchmark. Visually inspect systems, raceway, and equipment grounds to determine the adequacy and integrity of the grounding.
  - b. Test the ground grids for ground resistance to verify a maximum ground resistance of 2-5 ohms. Distribution Class lighting arrestor and towers are a maximum of 25 ohms.
    - (1) The fall-of-potential method using 2 auxiliary electrodes, or other suitable approved method, shall determine ground resistance values.
    - (2) Testing shall be performed as described in IEEE standard 81, IEEE Recommended Guide for Measuring Ground Resistance and Potential Gradients in the Earth.
- 7. Low Voltage Motors by Electrical Contractor:
  - a. At the time of motor receipt, visually inspect each motor for any physical damage.
  - b. Check motors for proper lubrication.
  - c. Test the insulation of low voltage motors with a 500 volt megger and record readings. Test the insulation of medium voltage motors with a 2500 volt megger and record readings. If a reading is found to be below 1 megohm per 1000 volts, the motor must be dried until a constant value above the minimum reading is reached.
  - d. The following tests shall be performed on medium voltage motors:
    - (1) Perform DC over-potential tests on motors rated at 1000 HP and greater, and 4000 volts and greater, in accordance with ANSI/IEEE Standard 95.
    - (2) Perform insulation power factor or dissipation factor tests.
    - (3) Perform surge comparison tests.
    - (4) Perform insulation resistance test on pedestal, in accordance with Manufacturer's instructions.
    - (5) Perform surge protection device tests.
    - (6) Check that the motor space heater circuit is in accordance with drawings.
    - (7) Check protective devices in accordance with other sections.
    - (8) Check RTD (Resistance Temperature Detector) circuits for conformance with drawings. Check that metering or relaying

devices using the RTDs are of the proper rating.

- e. Before energizing any machine, visually inspect for serviceability.
- f. Check Manufacturer's instruction manual for correct lubrication and ventilation. Verify that proper alignment has been performed.
- g. Check nameplate for electrical power requirements.
- h. Testrun motors, preferably uncoupled or unloaded, before placing into regular service. Check the motor for rotation, speed, current and temperature rise, and record the results.
- 8. 600 Volt Wire and Cable By Electrical Contractor:
  - a. Before energizing, measure the continuity and insulation resistance of every circuit external to equipment with a megger from each wire to all others, and ground.
  - b. Take insulation resistance measurements of the following:
    - (1) Motor Feeders:
      - (i) With motors disconnected, measure insulation resistance of motor feeders from load side of contactors or circuit breakers. Repeat this test after motors are connected and just before energizing at perhaps lower voltage as limited by the maximum test voltage for the motor.
    - (2) Lighting Panel Feeders:
      - (i) Measure insulation resistance of lighting and panel feeders with circuit breakers, lighting transformers, and panelboards connected, but with lighting branch circuit breakers or switches open.
    - (3) Feeder Circuits:
      - (i) Measure insulation resistance of feeder circuits with connections to circuit breakers made up, but with breakers open and load not connected.
    - (4) Lighting Branch Circuits:
      - (i) Measure insulation resistance after lamp holders, receptacles, fixtures, and other similar items are connected but before lamping.
    - (5) Check cables and wires for proper identification numbering or color coding.

# 3.03 INSPECTION AND TEST OF ELECTRICAL INSTALLATION:

A. Inspectors shall carefully review installation specifications issued for the project. They shall be familiar with applicable codes / standards and shall have copies available at the work locations for reference. Certain requirements may be defined in the specifications, but not called out on drawings, such as expansion joints in conduits, breathers, and drains, and support for cable in vertical conduit runs.

- B. Additional inspections may be carried out by third parties to meet legal requirements. City, State, or similar inspection shall not alleviate the requirement for inspection defined here.
- C. Underground Electrical:
  - 1. Inspect the in progress installation of the ground / earthing system. This activity shall include the following:
    - a. Ground/earthing rods for correct type and depth.
    - b. Ground/earthing conductors and connections, as each portion of the system is installed, prior to backfilling.
    - c. Verify that system is being installed in accordance with drawings. Ascertain that a record set of drawings reflecting as-built marks is being maintained.
    - d. Color code Underground Drawings as required to track in- progress installation. Document the inspection of the completed system for each Area / Unit, Grounding / Earthing System Inspection Record.
    - e. Test the resistance to earth for each ground/ earthing rod, or designated group of rods, or each foundation, as required by the drawings and specifications. Document the test data on Grounding / Earthing Resistance Readings Test Record.
  - 2. Inspect direct burial cable installation in accordance with drawings.
  - 3. Inspect in-progress ductbank and electrical manhole installations. Ensure that a record set of drawings reflecting as-built marks is being maintained.
- D. Aboveground Electrical:
  - 1. Inspect the in-progress installation of electrical conduit and cable trays. This activity shall also include the welding for electrical supports. Establish a jobsite qualification procedure for electrical welders to ensure sound welds.
  - 2. Inspect lighting panelboards and lighting installation.
  - 3. Inspect and test bonding to ground for equipment and structures.
  - 4. Inspect the in-progress installation of all cable. Medium and high voltage cable terminations shall be inspected.
  - 5. Electrical heat tracing shall be inspected.
  - 6. Inspect conduct seals and ensure that all seals have been poured after all cables have been pulled, tested, and Instrument Loop Checks completed. Document the inspection for each area / unit.

# 3.04 TEST AND INSPECTION REPORTS

- A. In addition to requirements specified elsewhere, report the following:
  - 1. Manufacturer's written testing and inspecting instructions.
  - 2. Calibration and adjustment settings of adjustable and interchangeable devices involved in tests.

- 3. Tabulation of expected measurement results made before measurements.
- 4. Tabulation of "as-found" and "as-left" measurement and observation results.

END OF SECTION 26 05 10

# 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. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.

#### 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 NFPA 70.

#### PART 2 - PRODUCTS

# 2.1 CONDUCTORS AND CABLES

- A. Manufacturers:
  - 1. American Insulated Wire Corp.; a Leviton Company.
  - 2. General Cable Corporation.
  - 3. Senator Wire & Cable Company.
  - 4. Southwire Company.

- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- C. Conductor Material:
  - 1. Copper complying with NEMA WC 5; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
  - 2. Aluminum alloy as manufactured by Alcan Stabiloy. Compact Aluminum conductor with type XHHW insulation. Aluminum may only be used as described on the drawings for wiring for feeders larger than 100A.
- D. Conductor Insulation Types: Type THHN-THWN, XHHW complying with NEMA WC 5.
- E. Multi-Conductor Cable: Copper Metal-clad cable, Type MC with ground wire.

# 2.2 CONNECTORS AND SPLICES

- A. Manufacturers:
  - 1. AMP Incorporated/Tyco International.
  - 2. Hubbell/Anderson.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

# PART 3 - EXECUTION

# 3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Aluminum wiring type XHHW, single conductors in raceway.
- B. Exposed panelboard feeders: Aluminum wiring type XHHW, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, and Partitions: Aluminum wiring type XHHW, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspaces: Aluminum wiring type XHHW, single conductors in raceway.
- E. Exposed Branch Circuits (100A or less), on precast walls and in Crawlspaces: Copper type THHN-THWN, single conductors in raceway.

- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions (100A or less): Copper type MC cable THHN-THWN.
- G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade (100A or less): Copper type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.
- I. Fire Alarm Circuits: Type THHN-THWN, in raceway or Plenum rated Power-limited, fireprotective, signaling circuit cable.
- J. Class 1 Control Circuits: Type THHN-THWN, in raceway.

# 3.2 INSTALLATION

- 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 Division 16 Section "Basic Electrical Materials and Methods."
- F. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."
- G. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."
- H. Type MC cable shall be routed at right angles to building structure and be supported at minimum of 6 foot intervals.
- I. Do not combine neutral conductors on any 120v branch circuit wiring. Provide separate independent neutral conductors.

# 3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torquetightening 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 12 inches of slack.

# 3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, megger test for compliance with requirements.

# END OF SECTION 26 05 19

# SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

# PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

A. This Section includes methods and materials for grounding systems.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
  - 1. Grounding arrangements and connections for separately derived systems.
  - 2. Grounding for sensitive electronic equipment.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
  - 1. Instructions for periodic testing and inspection of grounding features at ground rings, grounding connections for separately derived systems based on NFPA 70B
    - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    - b. Include recommended testing intervals.

# 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 UL 467 for grounding and bonding materials and equipment.

# PART 2 - PRODUCTS

# 2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

# 2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

# 2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad; 3/4 inches by10 feet in diameter.

PART 3 - EXECUTION

#### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger, unless otherwise indicated.
- B. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

# 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Metal-clad cable runs.
  - 8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic

raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

- E. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 3 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
  - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- F. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

# 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

END OF SECTION 26 05 26

# 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. This Section includes 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. IBC: International Building Code.
- C. IMC: Intermediate metal conduit.
- D. NBC: National Building Code.
- E. OSHPD: Office of Statewide Health Planning and Development.
- F. RMC: Rigid metal conduit.
- G. SBC: Standard Building Code.
- H. IBC: International Building Code.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

# 2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.
- B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.
  - 1. Manufacturers:
    - a. Cooper B-Line; a division of Cooper Industries.
    - b. ERICO International Corporation.
    - c. Allied Support Systems; Power-Strut Unit.
    - d. GS Metals Corp.
    - e. Michigan Hanger Co., Inc.; O-Strut Div.
    - f. National Pipe Hanger Corp.
    - g. Thomas & Betts Corporation.
    - h. Unistrut; Tyco International, Ltd.
  - 2. Finishes:
    - a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
    - b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-3.
    - c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-3.
  - 3. Channel Dimensions: Selected for structural loading and applicable seismic forces.
- C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1

surface.

- 1. Manufacturers:
  - a. Allied Support Systems; Aickinstrut Unit.
  - b. Cooper B-Line; a division of Cooper Industries.
  - c. Fabco Plastics Wholesale Limited.
  - d. Seasafe, Inc.
- 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
- 3. Fitting and Accessory Materials: Same as channels and angles.
- 4. Rated Strength: Selected to suit structural loading and applicable seismic forces.
- D. Raceway and Cable Supports: As described in NECA 1.
- E. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- F. 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.
- G. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- H. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers:
      - 1) Hilti, Inc.
      - 2) ITW Construction Products.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co. Inc.
  - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Manufacturers:
      - 1) Cooper B-Line; a division of Cooper Industries.

- 2) Empire Tool and Manufacturing Co., Inc.
- 3) Hilti, Inc.
- 4) ITW Construction Products.
- 5) MKT Fastening, LLC.
- 6) Powers Fasteners.
- 3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 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, high strength. Comply with ASTM A 325.
- 6. Toggle Bolts: All-steel springhead type.
- 7. Hanger Rods: Threaded steel.

# 2.3 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 5 Section "Metal Fabrications" for steel shapes and plates.

# PART 3 - EXECUTION

# 3.1 APPLICATION

- A. Comply with NECA 1 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 required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 50 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
  - 2. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch 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 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 within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 6. To Steel: 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 5 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. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.
- B. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt diameters from edge of the base.
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of the base.
  - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 6. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section "Cast-in-Place Concrete."

# 3.5 FIELD QUALITY CONTROL

- A. Testing: Test pullout resistance of seismic anchorage devices.
  - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
  - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  - 5. Test to 90 percent of rated proof load of device.
  - 6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- B. Record test results.

# END OF SECTION 26 05 29

# 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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

# 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquid-tight flexible metal conduit.
- F. LFNC: Liquid-tight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.

# 1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.

# 1.5 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 NFPA 70.

# 1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

# PART 2 - PRODUCTS

# 2.1 METAL CONDUIT AND TUBING

- A. Manufacturers:
  - 1. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
  - 2. LTV Steel Tubular Products Company.
  - 3. O-Z Gedney; Unit of General Signal.
  - 4. Wheatland Tube Co.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Aluminum Rigid Conduit: ANSI C80.5.
- D. IMC: ANSI C80.6.
- E. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
- F. Plastic-Coated IMC and Fittings: NEMA RN 1.
- G. EMT and Fittings: ANSI C80.3.
  - 1. Fittings: Set-screw type.
- H. FMC: Aluminum.
- I. LFMC: Flexible steel conduit with PVC jacket.
- J. Fittings: NEMA FB 1; compatible with conduit and tubing materials.
## 2.2 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers:
  - 1. American International.
  - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 3. Arnco Corp.
  - 4. Cantex Inc.
  - 5. Certainteed Corp.; Pipe & Plastics Group.
  - 6. Condux International.
  - 7. ElecSYS, Inc.
  - 8. Electri-Flex Co.
  - 9. Lamson & Sessions; Carlon Electrical Products.
  - 10. Manhattan/CDT/Cole-Flex.
  - 11. RACO; Division of Hubbell, Inc.
  - 12. Spiralduct, Inc./AFC Cable Systems, Inc.
  - 13. Thomas & Betts Corporation.
- B. ENT: NEMA TC 13.
- C. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
- D. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.
- E. LFNC: UL 1660.
- 2.3 METAL WIREWAYS
  - A. Manufacturers:
    - 1. Hoffman.
    - 2. Square D.
  - B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1 or 3R as required.
  - C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, and other fittings to match and mate with wireways as required for complete system.
  - D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
  - E. Wireway Covers: Hinged type.
  - F. Finish: Manufacturer's standard enamel finish.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers:
  - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 2. Emerson/General Signal; Appleton Electric Company.
  - 3. Erickson Electrical Equipment Co.
  - 4. Hoffman.
  - 5. Hubbell, Inc.; Killark Electric Manufacturing Co.
  - 6. O-Z/Gedney; Unit of General Signal.
  - 7. RACO; Division of Hubbell, Inc.
  - 8. Robroy Industries, Inc.; Enclosure Division.
  - 9. Scott Fetzer Co.; Adalet-PLM Division.
  - 10. Spring City Electrical Manufacturing Co.
  - 11. Thomas & Betts Corporation.
  - 12. Walker Systems, Inc.; Wiremold Company (The).
  - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1, minimum depth of 2-1/8".
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- D. Floor Boxes: See drawings.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

## 2.5 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

- 3.1 RACEWAY APPLICATION
  - A. Outdoors:
    - 1. Exposed: Rigid steel.
    - 2. Concealed: Rigid steel.
    - 3. Underground, Single Run: RNC.
    - 4. Underground, Grouped: RNC.
    - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
    - 6. Boxes and Enclosures: NEMA 250, Type 3R.
  - B. Indoors:
    - 1. Exposed: EMT.
    - 2. Concealed: EMT.
    - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
    - 4. Damp or Wet Locations: Rigid steel conduit.
    - 5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
      - a. Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.
  - C. Minimum Raceway Size: 3/4-inch trade size.
  - D. Raceway Fittings: Compatible with raceways and suitable for use and location.
    - 1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
    - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
  - E. Do not install any RNC above the floor slab or grade.

### 3.2 INSTALLATION

- A. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- B. Complete raceway installation before starting conductor installation.
- C. Support raceways as specified in Division 16 Section "Electrical Supports."

- D. Install temporary closures to prevent foreign matter from entering raceways.
- E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
  - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- H. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
  - 1. Run parallel or banked raceways together on common supports.
  - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- I. Join raceways with fittings designed and approved for that purpose and make joints tight.
  - 1. Use insulating bushings to protect conductors.
- J. Tighten set screws of thread-less fittings with suitable tools.
- K. Terminations:
  - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
  - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- M. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 100 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- N. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-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 NFPA 70.
- O. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- P. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- Q. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
- R. Set floor boxes level and flush with finished floor surface.
- S. Set floor boxes level. Trim after installation to fit flush with finished floor surface.
- T. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- U. Do not install any conduit in the floor slab. Any conduit allowed to be installed under the floor the engineer shall be installed minimum of 6" below the bottom of the floor slab.
- V. Do not install any branch circuit conduit below the floor slab without expressed permission by engineer.

# 3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

# 3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 26 05 33

# SECTION 26 05 36 – CABLE TRAYS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

A. This Section includes steel cable trays and accessories.

#### 1.3 SUBMITTALS

- A. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.
- B. Shop Drawings: For each type of cable tray.
  - 1. Show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
  - 2. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.
    - a. Design Calculations: Calculate requirements for selecting seismic restraints.
    - b. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.
- C. Coordination Drawings: Floor plans and sections, drawn to scale. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements. Show the following:
  - 1. Vertical and horizontal offsets and transitions.
  - 2. Clearances for access above and to side of cable trays.
  - 3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
- D. Field quality-control reports.

E. Operation and Maintenance Data: For cable trays to include in emergency, operation, and maintenance manuals.

### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.
- 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 NFPA 70.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store indoors to prevent water or other foreign materials from staining or adhering to cable tray. Unpack and dry wet materials before storage.
- B. Cable tray shall be stored in a well-ventilated, dry location. Unpack and dry wet materials before storage.

### PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Chalfant Manufacturing Company.
  - 2. Cooper B-Line, Inc.
  - 3. Cope, T. J., Inc.; a subsidiary of Allied Tube & Conduit.
  - 4. GS Metals Corp.; GLOBETRAY Products.
  - 5. MONO-SYSTEMS, Inc.
  - 6. MP Husky.
  - 7. PW Industries.

# 2.2 MATERIALS AND FINISHES

- A. Cable Trays, Fittings, and Accessories: Steel, complying with NEMA VE 1.
  - 1. Factory-standard primer, ready for field painting; with cadmium-plated hardware according to ASTM B 766.
  - 2. Mill galvanized before fabrication, complying with ASTM A 653/A 653M, G90 (Z275) coating; with hardware galvanized according to ASTM B 633, or electrogalvanized before fabrication, complying with ASTM B 633; with hardware galvanized according to ASTM B 633.
- B. Cable Trays, Fittings, and Accessories: Aluminum, complying with NEMA VE 1, Aluminum Association's Alloy 6063-T6 for rails, rungs, and cable trays, and Alloy 5052-H32 or Alloy 6061-T6 for fabricated parts; with chromium-zinc, ASTM F 1136 splice-plate fasteners, bolts, and screws
- C. Sizes and Configurations: Refer to the Drawings for specific requirements for sizes and configurations.
  - 1. Center-hanger supports may be used only when specifically indicated.

#### 2.3 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

# PART 3 - EXECUTION

### 3.1 CABLE TRAY INSTALLATION

- A. Comply with recommendations in NEMA VE 2. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.
- B. Remove burrs and sharp edges from cable trays.
- C. Fasten cable tray supports to building structure.
  - 1. Place supports so that spans do not exceed maximum spans per manufacturer's data and recommendations.

- 2. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
- 3. Support bus assembly to prevent twisting from eccentric loading.
- 4. Manufacture center-hung support, designed for 60 percent versus 40 percent eccentric loading condition, with a safety factor of 3.
- 5. Locate and install supports according to NEMA VE 1.
- D. Make connections to equipment with flanged fittings fastened to cable tray and to equipment. Support cable tray independent of fittings. Do not carry weight of cable tray on equipment enclosure.
- E. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA VE 1. Space connectors and set gaps according to applicable standard.
- F. Make changes in direction and elevation using standard fittings.
- G. Make cable tray connections using standard fittings.
- H. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."
- I. Sleeves for Future Cables: Install capped sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- J. Workspace: Install cable trays with enough space to permit access for installing cables.
- K. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.
- L. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

# 3.2 CABLE INSTALLATION

- A. Install cables only when cable tray installation has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
- C. On vertical runs, fasten cables to tray every 18 inches (457 mm). Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

### 3.3 CONNECTIONS

- A. Ground cable trays according to manufacturer's written instructions.
- B. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.

# 3.4 FIELD QUALITY CONTROL

- A. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:
  - 1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.
  - 2. Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.
  - 3. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.
  - 4. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.
  - 5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
  - 6. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
  - 7. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.
- B. Report results in writing.

### 3.5 PROTECTION

- A. Protect installed cable trays.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by cable tray manufacturer.

3. Install temporary protection for cables in open trays to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials until the risk of damage is over.

END OF SECTION 26 05 36

# 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. This Section includes the following:
  - 1. Identification for raceway.
  - 2. Identification for conductors and communication and control cable.
  - 3. Underground-line warning tape.
  - 4. Equipment identification labels.
  - 5. Miscellaneous identification products.

### 1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

### 1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

## 1.5 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 RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
  - 1. Normal Power Circuits: Black letters on white field.
  - 2. Emergency Power Circuits: White letters on red field.
  - 3. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves,
  2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

# 2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

- C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.
- E. Write-On Tags: Polyester tag, 0.015 inches thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

# 2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  - 1. Not less than 6 inches 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.

### 2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

# 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 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

#### 3.1 APPLICATION

- A. Junction Boxes: Identify all junction box covers indicating the circuits contained in the box. Use a marker for this identification.
- B. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- C. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
- D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- E. 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.
- F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
- G. 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: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label 4 inches high.

- 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. Disconnect switches.
  - f. Enclosed circuit breakers.
  - g. Motor starters.
  - h. Push-button stations.
  - i. Contactors.
  - j. Remote-controlled switches, dimmer modules, and control devices.
  - k. Voice and data cable terminal equipment.
  - I. Television/audio components, racks, and controls.
  - m. Fire-alarm control panel and annunciators.
  - n. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
  - o. 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 non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

- G. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 2. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  - 3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

END OF SECTION 26 05 53

SECTION 26 09 23 – LIGHTING CONTROL DEVICES

### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following lighting control devices:
  - 1. Time switches.
  - 2. Outdoor photoelectric switches.
  - 3. Indoor occupancy sensors.
  - 4. Lighting contactors.
- B. Related Sections include the following:
  - 1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

#### 1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light level sensors.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

### 1.5 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.

#### 1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

### PART 2 - PRODUCTS

### 2.1 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Intermatic, Inc.
  - 2. Paragon Electric Co.; Invensys Climate Controls.
  - 3. TORK.
- B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
  - 1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range.
  - 2. Time Delay: 15-second minimum, to prevent false operation.
  - 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
  - 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

### 2.2 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Lighting.
  - 2. Leviton Mfg. Company Inc.

- 3. Lithonia Lighting; Acuity Lighting Group, Inc.
- 4. Sensor Switch, Inc.
- 5. Watt Stopper (The).
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
  - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  - 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
  - 4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  - 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
  - 6. Bypass Switch: Override the on function in case of sensor failure.
- C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
  - 1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
  - 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
  - 3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.
- D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
  - 1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
  - 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

- 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
- 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
- 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).
- E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
  - 1. Sensitivity Adjustment: Separate for each sensing technology.
  - Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
  - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

# 2.3 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Allen-Bradley/Rockwell Automation.
  - 2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
  - 3. Eaton Electrical Inc.; Cutler-Hammer Products.
  - 4. GE Industrial Systems; Total Lighting Control.
  - 5. Square D; Schneider Electric.
- B. Description: Electrically operated and mechanically held, combination type, complying with NEMA ICS 2 and UL 508.
  - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
  - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  - 3. Enclosure: Comply with NEMA 250.
  - 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

### 2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### PART 3 - EXECUTION

### 3.1 SENSOR SELECTION

- A. Provide PIR type in offices and general spaces.
- B. Provide ultrasonic type sensors in restrooms and corridors. Sensors in corridors shall have coverage pattern designed for corridor use.
- C. Provide dual technology type in warehouse and other spaces where dual technology type is suitable and appropriate.
- D. Submit sensor layout design to Engineer for review.

### 3.2 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

### 3.3 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

### 3.4 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

# 3.5 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

## 3.6 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  - 2. Operational Test: Verify operation of each lighting control device and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

## 3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 26 09 23

# SECTION 26 09 43 – NETWORK LIGHTING CONTROLS

#### 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 manually operated, PC-based, digital lighting controls with external signal source relays and control module.
- B. Related Sections include the following:
  - 1. Division 26 Section "Lighting Control Devices" for time switches, photoelectric switches, occupancy sensors, and multipole contactors.

#### 1.3 DEFINITIONS

- A. BACnet: A networking communication protocol that complies with ASHRAE 135.
- B. BAS: Building automation system.
- C. DALI: Digital addressable lighting interface.
- D. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.
- E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.
- F. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- G. PC: Personal computer; sometimes plural as "PCs."
- H. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.

I. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A.

#### 1.4 SUBMITTALS

- A. Product Data: For control modules, power distribution components, manual switches and plates, and conductors and cables.
- B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.
  - 1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
  - 2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
  - 3. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
- C. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
  - 1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
  - 2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.
- D. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.
- E. Field quality-control test reports.
- F. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.
- G. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- H. Warranty: Special warranty specified in this Section.

### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.
- 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 47 CFR, Subparts A and B, for Class A digital devices.
- D. Comply with protocol described in IEC 60929, Annex E, for DALI lighting control devices, wiring, and computer hardware and software.
- E. Comply with NFPA 70.

### 1.6 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
  - 1. Match components and interconnections for optimum performance of lighting control functions.
  - 2. Coordinate lighting controls with BAS. Design display graphics showing building areas controlled; include the status of lighting controls in each area.

### 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of software input/output to execute switching or dimming commands.
    - b. Failure of modular relays to operate under manual or software commands.
    - c. Damage of electronic components due to transient voltage surges.
  - 2. Warranty Period: Two years from date of Substantial Completion.
  - 3. Extended Warranty Period Failure Due to Transient Voltage Surges: Eight years.
  - 4. Extended Warranty Period for Electrically Held Relays: 10 years from date of Substantial Completion.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Electrically Held Relays: Equal to 10 percent of amount installed for each size indicated, but no fewer than 5 relays.

### 1.9 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revise licenses for use of the software.
  - 1. Provide 30-day notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment, if necessary.

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Leviton Mfg. Company Inc.
  - 2. Cooper Controls
  - 3. Hubbell
  - 4. Lutron Electronics Company, Inc.

### 2.2 SYSTEM REQUIREMENTS

- A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.
- B. Performance Requirements: Manual switches, an internal timing and control unit, and external sensors or other control signal sources send a signal to a PC-based programmable-system control module that processes the signal according to its programming and routes an

open or close command to one or more relays in the power-supply circuits, or routes variable commands to one or more dimmers, for groups of lighting fixtures or other loads.

# 2.3 CONTROL MODULE

- A. Control Module Description: Programmable, PC-based unit and programming of system status and to override relay status; and to display status of local override controls and diagnostic information. If the control module is applied to emergency lighting units, control unit shall indicate failure of normal power and that the lighting units are, or are not, powered by the alternate power source.
  - 1. Interoperability: Lighting control shall be configured to allow individual users to turn lighting on and off with their PCs. Software shall be written for Windows operating system, with Web page as the display and ActiveX controls that can be accessed through an Internet browser. Include at least three levels of password protection. Include an egress lighting option that will provide each user with a lighted path for exiting the building after normal working hours.
  - 2. System Memory: Nonvolatile. System shall reboot program and reset time automatically without errors after power outages up to 90 days' duration.
  - 3. Software: Lighting control software shall be capable of linking switch inputs to relay outputs, retrieving links, viewing relay output status, controlling relay outputs, simulating switch inputs, setting device addresses, and assigning switch input and relay output modes.
  - 4. Automatic Time Adjustment: System shall automatically adjust for leap year and daylight saving time and shall provide weekly routine and annual holiday scheduling.
  - 5. Astronomic Control: Automatic adjustment of dawn and dusk switching.
  - 6. Confirmation: Each relay or contactor device operated by system shall have auxiliary contacts that provide a confirmation signal to the system of on or off status of device. On or off status confirmation for each electrically operated circuit breaker shall be provided by an auxiliary contact or by a sensing device at load terminal.
    - a. Software shall interpret status signals, provide for their display, and initiate failure signals.
    - b. Lamp or LED at control module or display panel shall identify status of each controlled circuit.
  - 7. Remote Communication Capability: Allow programming, data-gathering interrogation, status display, and controlled command override from a PC at a remote location over data links. System shall include modem, communications and control software, and remote computer compatibility verification for this purpose.
  - 8. BAS System Interface: Provide building automation system interface to allow control and status indication of all relays. Provide all interface equipment necessary to allow communication. Coordinate requirements with BAS system supplier.

- 9. Local Override Capability: Manual, low-voltage control devices shall override programmed shutdown of lighting and shall override other programmed control for intervals that may be duration programmed.
- 10. Automatic Control of Local Override: Automatic control shall switch lighting off if lighting has been switched on by local override
- 11. Automatic battery backup shall provide power to maintain program and system clock operation for 90 days' minimum duration when power is off.
- 12. Programmed time signals shall change preset scenes and dimmer settings.
- 13. Flick Warning: Programmable momentary turnoff of lights shall warn that programmed shutoff will occur after a preset interval. Warning shall be repeated after a second preset interval before end of programmed override period.
- 14. Diagnostics: When system operates improperly, software shall initiate factoryprogrammed diagnosis of failure and display messages identifying problem and possible causes.
- 15. Additional Programming: In addition to system programming by the PC, individual control modules shall be programmable using data-entry and -retrieval (such as PCs, personal digital assistants (PDAs), hand-held infrared programming devices, wired Ethernet hubs, wireless IEEE 802.11 hubs.

# 2.4 POWER DISTRIBUTION COMPONENTS

- A. Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.
  - 1. Cabinet: Steel with hinged, locking door.
    - a. Barriers separate low-voltage and line-voltage components.
    - b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
    - c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
  - 2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentarypulsed type.
    - a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
    - b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
    - c. Endurance: 50,000 cycles at rated capacity.
    - d. Mounting: Provision for easy removal and installation in relay cabinet.
- B. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels.

C. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels or field-mounting surge suppressors that comply with Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" for Category A locations.

## 2.5 MANUAL SWITCHES AND PLATES

- A. Push-Button Switches: Modular, momentary-contact, low-voltage type.
  - 1. Match color specified in Division 26 Section "Wiring Devices."
  - 2. Integral green LED pilot light to indicate when circuit is on.
  - 3. Internal white LED locator light to illuminate when circuit is off.
- B. Manual, Maintained Contact, Full- or Low-Voltage Switch: Comply with Division 26 Section "Wiring Devices."
- C. Wall-Box Dimmers: Comply with Division 26 Section "Wiring Devices."
- D. Wall Plates: Single and multi-gang plates as specified in Division 26 Section "Wiring Devices."
- E. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

# 2.6 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 22 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 6 for horizontal copper cable and with Division 27 Section "Communications Horizontal Cabling."

PART 3 - EXECUTION

- 3.1 WIRING INSTALLATION
  - A. Comply with NECA 1.
  - B. Wiring Method: Install wiring in raceways except where installed in accessible ceilings. Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be ¾ inch.
  - C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
  - D. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
  - E. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
  - F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.
  - G. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

### 3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Test for circuit continuity.
  - 2. Verify that the control module features are operational.
  - 3. Check operation of local override controls.
  - 4. Test system diagnostics by simulating improper operation of several components selected by Architect.

## 3.3 SOFTWARE INSTALLATION

A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

### 3.4 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors and to assist Owner's personnel in making program changes to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

# 3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting controls and software training for PC-based control systems. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 09 43

### SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
  - 1. Distribution transformers.

#### 1.3 SUBMITTALS

- A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- 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 IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

# 1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

# 1.6 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchorbolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ACME Electric Corporation; Power Distribution Products Division.
  - 2. Eaton Electrical Inc.; Cutler-Hammer Products.
  - 3. General Electric Company.
  - 4. Hammond Co.; Matra Electric, Inc.
  - 5. Siemens Energy & Automation, Inc.
  - 6. Sola/Hevi-Duty.
  - 7. Square D; Schneider Electric.

# 2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
  - 1. Internal Coil Connections: Brazed or pressure type.
  - 2. Coil Material: Aluminum.
# 2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Enclosure: Ventilated, NEMA 250, Type 3R.
  - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- D. Transformer Enclosure Finish: Comply with NEMA 250.
  - 1. Finish Color: Gray.
- E. Taps for Transformers Smaller Than 3 kVA: None.
- F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- H. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- I. Energy Efficiency for Transformers Rated 15 kVA and Larger:
  - 1. Complying with DOE 2016 Energy Efficiency Standard.
  - 2. Tested according to NEMA TP 2.
- J. Wall Brackets: Manufacturer's standard brackets.
- K. Fungus Proofing: Permanent fungicidal treatment for coil and core.
- L. Low-Sound-Level Requirements: Maximum sound levels, when factory tested according to IEEE C57.12.91, as follows:
  - 1. 9 kVA and Less: 40 dBA
  - 2. 30 to 50 kVA: 45 dBA
  - 3. 51 to 150 kVA: 50 dBA
  - 4. 151 to 300 kVA: 55 dBA
  - 5. 301 to 500 kVA: 60 dBA
  - 6. 501 to 750 kVA: 62 dBA
  - 7. 751 to 1000 kVA: 64 dBA

# 2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each [distribution] [buckboost] transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

## PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
  - 1. Brace wall-mounting transformers as specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems.

## 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

# 3.4 ADJUSTING

- A. Record transformer secondary voltage under facility's typical operating load. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

# 3.5 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 22 00

## SECTION 26 24 16 - PANELBOARDS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

## 1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.

- c. Short-circuit current rating of panelboards and overcurrent protective devices.
- d. UL listing for series rating of installed devices.
- e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

# 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: Not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 1000 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 1000 feet.

# 1.7 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents:
  - 1. Keys: Six spares for each type of panelboard cabinet lock.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
    - a. Eaton Corporation; Cutler-Hammer Products.
    - b. General Electric Co.; Electrical Distribution & Protection Div.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D.

## 2.2 MANUFACTURED UNITS

- A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
  - 1. Rated for environmental conditions at installed location.
    - a. Outdoor Locations: NEMA 250, Type 3R.
    - b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
    - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
    - d. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
  - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
  - 3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
  - 4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- B. Phase and Ground Buses:
  - 1. Material: Copper.
  - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- C. Conductor Connectors: Suitable for use with conductor material.
  - 1. Main and Neutral Lugs: Mechanical type.
  - 2. Ground Lugs and Bus Configured Terminators: Compression type.
  - 3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
- D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

# 2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. UL label indicating series-connected rating with integral or remote upstream overcurrent protective devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.
- B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

## 2.4 DISTRIBUTION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.
- B. Main Overcurrent Protective Devices: as scheduled.
- C. Branch Overcurrent Protective Devices:
  - 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
  - 2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
  - 3. Fused switches.
- D. Transient Voltage Suppression Devices (Main Distribution panelboard only)
  - 1. IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.
  - 2. Minimum single-impulse current rating shall be as follows:
    - a. Line to Neutral: 200,000 A.
    - b. Line to Ground: 200,000 A.
    - c. Neutral to Ground: 100,000 A.
  - 3. Protection modes shall be as follows:
    - a. Line to neutral.
    - b. Line to ground.
    - c. Neutral to ground.
  - 4. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
  - 5. Maximum Category C combination wave clamping voltage shall not exceed 600 V, line to neutral and line to ground on 120/208 V systems
  - 6. Maximum UL 1449 clamping levels shall not exceed 600 V, line to neutral and line to ground on 277/480 V systems.
  - 7. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
  - 8. Accessories:
    - a. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
    - b. Audible alarm activated on failure of any surge diversion module
  - 9. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V

#### 2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

# 2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with series-connected rating to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with frontmounted, field-adjustable trip setting.
  - 3. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
  - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - 4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
  - 5. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- D. Fuses are specified in Division 16 Section "Fuses."

## 2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."
- C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
  - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub empty 3/4-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Provide (1) conduit for every (3) spare circuit breakers.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

## 3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

# 3.3 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."

# 3.4 FIELD QUALITY CONTROL

- A. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
  - 1. Measure as directed during period of normal system loading.
  - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

# 3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16

## SECTION 26 27 13 – ELECTRICITY METERING

#### 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 equipment for utility company's electricity metering.

#### 1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe electrical characteristics, features, and operating sequences, both automatic and manual. Include the following:
  - 1. Electricity-metering equipment.

#### 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.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, store, and handle modular meter center as specified in NECA 400.

#### 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify the Owner no fewer than seven days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without the Owner's written permission.

#### 1.7 COORDINATION

- A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:
  - 1. Comply with requirements of utilities providing electrical power and communication services.
  - 2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company.

## PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install equipment for utility company metering. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

END OF SECTION 26 27 13

# 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. This Section includes the following:
  - 1. Single and duplex receptacles, ground-fault circuit interrupters, integral surge suppression units, and isolated-ground receptacles.
  - 2. Single- and double-pole snap switches and dimmer switches.
  - 3. Device wall plates.
  - 4. Pin and sleeve connectors and receptacles.
  - 5. 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. PVC: Polyvinyl chloride.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

# 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.

# 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
- 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 NFPA 70.

## 1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Wiring Devices:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. Leviton Mfg. Company Inc.
    - c. Pass & Seymour/Legrand; Wiring Devices Div.

# 2.2 RECEPTACLES

- A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498, rated 20A, 125 VAC, grounding type.
- B. Straight-Blade and Locking Receptacles: Specification Duty grade.
- C. GFCI Receptacles: Straight blade, feed through type, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943 rated

20A, 125 VAC. Design units for installation in a 2-3/4-inch- deep outlet box without an adapter.

#### 2.3 SWITCHES

- A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20, rated 20A, 120/277 VAC.
- B. Switches connected to emergency power shall be red self-illuminating type with characteristics as listed in A. above.
- C. Snap Switches: Heavy Duty grade, quiet type, rated 20A, 277/120 VAC.
- D. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.
  - 1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.
  - 2. Incandescent Lamp Dimmers: Modular, 2000va, 120 V, 60 Hz with continuously adjustable slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch wire connecting leads.
  - 3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

## 2.4 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: Smooth, high-impact nylon.
  - 3. Material for Wet Locations: Metal with spring-loaded lift type cover and listed and labeled for use in "wet locations."
- 2.5 FINISHES
  - A. Color:
    - 1. Wiring Devices Connected to Normal Power System: White devices with white cover plates, unless otherwise indicated or required by NFPA 70.

## PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install devices and assemblies level, plumb, and square with building lines.
- B. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.
- C. Install unshared neutral conductors on-line and load side of dimmers according to manufacturers' written instructions.
- D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multi-gang wall plates.
- E. Remove wall plates and protect devices and assemblies during painting.
- F. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

## 3.2 IDENTIFICATION

- A. Comply with Division 16 Section "Electrical Identification."
  - 1. Receptacles: Identify panelboard and circuit number from which served.
    - a. Use self adhesive machine printing with black lettering on outside face of plate of all receptacles in the lab areas, and durable wire markers or tags inside outlet boxes.
    - b. All receptacles outside lab areas shall be labeled with permanent marker on the inside of the coverplate.

## 3.3 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

# 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
  - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
  - 3. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 26 27 26

# SECTION 26 28 13 - FUSES

# PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Cartridge fuses rated 600 V and less for use in switches and switchboards.
  - 2. Spare-fuse cabinets.

## 1.3 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
  - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  - 2. Let-through current curves for fuses with current-limiting characteristics.
  - 3. Time-current curves, coordination charts and tables, and related data.
  - 4. Fuse size for elevator feeders and elevator disconnect switches.
- B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
  - 1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
  - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
    - a. Let-through current curves for fuses with current-limiting characteristics.
    - b. Time-current curves, coordination charts and tables, and related data.

c. Ambient temperature adjustment information.

## 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- 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 NEMA FU 1.
- D. Comply with NFPA 70.

# 1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

## 1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Quantity equal to 10 percent of each fuse type and size, but no fewer than 3 of each type and size.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Bussman, Inc.
  - 2. Ferraz Shawmut, Inc.
  - 3. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

# 2.2 CARTRIDGE FUSES

A. Characteristics: NEMA RK-1, current limiting, time delay type fuses.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 FUSE APPLICATIONS

- A. Service Entrance: Class RK1, time delay.
- B. Feeders: Class RK1, time delay.
- C. Motor Branch Circuits: Class RK1, time delay.
- D. Other Branch Circuits: Class RK1, time delay.

## 3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

## 3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

## END OF SECTION 26 28 13

# SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
  - 1. Fusible switches.
  - 2. Non-fusible switches.
  - 3. Enclosures.

#### 1.3 DEFINITIONS

- A. GD: General duty.
- B. GFCI: Ground-fault circuit interrupter.
- C. HD: Heavy duty.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current rating.
  - 4. UL listing for series rating of installed devices.

- 5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

# 1.5 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 NFPA 70.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

# 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 1000 feet.

# 1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

# PART 2 - PRODUCTS

- 2.1 FUSIBLE AND NONFUSIBLE SWITCHES
  - A. Manufacturers:
    - 1. Eaton Corporation; Cutler-Hammer Products.

## ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- 2. General Electric Co.; Electrical Distribution & Control Division.
- 3. Siemens Energy & Automation, Inc.
- 4. Square D/Group Schneider.
- B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Non-Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
  - 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

## 2.2 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location:
  - 1. Outdoor Locations: NEMA 250, Type 3R.
  - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  - 4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Comply with mounting and anchoring requirements specified in Section "Electrical Supports."

# 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Section "Identification for Electrical Systems."

# 3.4 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

# END OF SECTION 26 28 16

# SECTION 26 51 00 – INTERIOR LIGHTING

## PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Interior lighting fixtures, lamps, and ballasts.
  - 2. Emergency lighting units.
  - 3. Exit signs.
  - 4. Lighting fixture supports.

#### 1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. CU: Coefficient of utilization.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.
- G. RCR: Room cavity ratio.

# 1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Emergency lighting units including battery and charger.

- 3. Ballast.
- 4. Energy-efficiency data.
- 5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Division 15 Section "Diffusers, Registers, and Grilles."
- 6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 15 Section "Diffusers, Registers, and Grilles."
- 7. Life, output, and energy-efficiency data for lamps.
- 8. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
  - a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
  - b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
  - 1. Wiring Diagrams: Power wiring.
- C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- D. Qualification Data: For agencies providing photometric data for lighting fixtures.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- G. Warranties: Special warranties specified in this Section.

## 1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- 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 NFPA 70.
- D. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

#### 1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

## 1.7 WARRANTY

- A. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- 2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS
  - A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
  - B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
  - C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
  - D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
  - E. Metal Parts: Free of burrs and sharp corners and edges.

- F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
  - 4. Laminated Silver Metallized Film: 90 percent.
- I. Plastic Diffusers, Covers, and Globes:
  - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
    - b. UV stabilized.
  - 2. Glass: Annealed crystal glass, unless otherwise indicated.

## 2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. Electronic Ballasts: Comply with ANSI C82.11; program-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.
  - 1. Sound Rating: A.
  - 2. Total Harmonic Distortion Rating: Less than 10 percent.
  - 3. Transient Voltage Protection: IEEE C62.41, Category A or better.
  - 4. Operating Frequency: 20 kHz or higher.
  - 5. Lamp Current Crest Factor: 1.7 or less.
  - 6. BF: 0.85 or higher.
  - 7. Power Factor: 0.95 or higher.
  - 8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

# 2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
  - 1. Lamp end-of-life detection and shutdown circuit.
  - 2. Automatic lamp starting after lamp replacement.
  - 3. Sound Rating: A.
  - 4. Total Harmonic Distortion Rating: Less than 10 percent.
  - 5. Transient Voltage Protection: IEEE C62.41, Category A or better.
  - 6. Operating Frequency: 20 kHz or higher.
  - 7. Lamp Current Crest Factor: 1.7 or less.
  - 8. BF: 0.95 or higher, unless otherwise indicated.
  - 9. Power Factor: 0.95 or higher.
  - 10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
  - 11. Ballast Case Temperature: 75 deg C, maximum.

## 2.5 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:
  - 1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
  - 2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.
  - 3. Normal Ambient Operating Temperature: 104 deg F.
  - 4. Open-circuit operation that will not reduce average life.
  - 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- B. Auxiliary Instant-On Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent light output.

## 2.6 FLUORESCENT LAMPS

- A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours, unless otherwise indicated.
- B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours, unless otherwise indicated.

- C. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, unless otherwise indicated.
  - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
  - 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
  - 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
  - 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
  - 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
  - 6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

# 2.7 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.
  - 1. Dual-Arc Tube Lamps: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
- B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.

## 2.8 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 16 Section "Electrical Supports" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Do not use grid as a support element.
  - 1. Install a minimum of two ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
  - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
  - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
  - 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- C. Suspended Lighting Fixture Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
  - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
- E. Adjust aimable lighting fixtures to provide required light intensities.
- F. Connect wiring according to Section "Conductors and Cables."
- G. All light fixtures installed in one hour ceiling shall have 1 hour protective tent or 1 hour enclosure installed over fixture housing. The electrical contractor shall provide this equipment to maintain integrity of the 1 hour ceiling.

# 3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 51 00
# SECTION 26 56 00 – EXTERIOR LIGHTING

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Exterior luminaires with lamps and ballasts.
  - 2. Luminaire-mounted photoelectric relays.
  - 3. Poles and accessories.
  - 4. Luminaire lowering devices.
- B. Related Sections include the following:
  - 1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

## 1.3 DEFINITIONS

- A. CRI: Color-rendering index.
- B. HID: High-intensity discharge.
- C. Luminaire: Complete lighting fixture, including ballast housing if provided.
- D. Pole: Luminaire support structure, including tower used for large area illumination.
- E. Standard: Same definition as "Pole" above.

## 1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.
- B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4.

#### EXTERIOR LIGHTING

- C. Ice Load: Load of 3 lbf/sq. ft. (143.6 Pa), applied as stated in AASHTO LTS-4.
- D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.
  - 1. Wind speed for calculating wind load for poles is 110 mph (177 km/h).

## 1.5 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
  - 2. Details of attaching luminaires and accessories.
  - 3. Details of installation and construction.
  - 4. Luminaire materials.
  - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
    - a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    - b. Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
  - 6. Photoelectric relays.
  - 7. Ballasts, including energy-efficiency data.
  - 8. Lamps, including life, output, and energy-efficiency data.
  - 9. Materials, dimensions, and finishes of poles.
  - 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
  - 11. Anchor bolts for poles.
  - 12. Manufactured pole foundations.
- B. Shop Drawings:
  - 1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
  - 2. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
  - 3. Wiring Diagrams: Power and control wiring.
- C. Samples for Verification: For products designated for sample submission in Exterior Lighting Device Schedule. Each sample shall include lamps and ballasts.

- D. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.
- E. Qualification Data: For agencies providing photometric data for lighting fixtures.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.
- H. Warranty: Special warranty specified in this Section.

## 1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C2, "National Electrical Safety Code."
- E. Comply with NFPA 70.
- 1.7 DELIVERY, STORAGE, AND HANDLING
  - A. Package aluminum poles for shipping according to ASTM B 660.
  - B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
  - C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below ground line.
  - D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
  - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
  - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
  - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
  - 4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. In Exterior Lighting Device Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  - 3. Basis of Design Product: The design of each item of exterior luminaire and its support is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

# 2.2 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
  - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

- a. Color: As selected from manufacturer's standard catalog of colors.
- b. Color: Match Architect's sample of manufacturer's standard color.
- c. Color: As selected by Architect from manufacturer's full range.
- N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
  - 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
  - 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

# PART 3 - EXECUTION

- 3.1 LUMINAIRE INSTALLATION
  - A. Install lamps in each luminaire.
  - B. Fasten luminaire to indicated structural supports.
    - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
  - C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

## 3.2 POLE INSTALLATION

- A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
  - 1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
  - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).

- 3. Trees: 15 feet (5 m).
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level recommended by pole manufacturer.
  - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
  - 2. Grout void between pole base and foundation. Use non-shrink or expanding concrete grout firmly packed to fill space.
  - 3. Install base covers, unless otherwise indicated.
  - 4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

# 3.3 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
  - 1. Install grounding electrode for each pole, unless otherwise indicated.
  - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
  - 1. Install grounding electrode for each pole.
  - 2. Install grounding conductor and conductor protector.
  - 3. Ground metallic components of pole accessories and foundations.

## 3.4 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
  - 1. Verify operation of photoelectric controls.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 56 00

# 127 DIVISION

# SECTION 27 05 00 – COMMON WORK RESULTS FOR COMMUNICATIONS

## 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. Communications equipment coordination and installation.
  - 2. Sleeves for pathways and cables.
  - 3. Sleeve seals.
  - 4. Grout.
  - 5. Common communications installation requirements.

#### 1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

## 1.4 QUALITY ASSURANCE

- A. All cabling shall meet ANSI/TIA/EIA-568.
- B. Termination and testing of the telecommunication cabling shall be performed by qualified telecommunication installer with at least 5 years experience that can assure the installation and testing parameters are met.
  - 1. Experience with Category 6e installation is required.
  - 2. Vendors and contractors shall have on staff a Building Industry Consulting Service International (BICSI) Registered Communications Distribution Designer (RCDD).
  - 3. The RCDD shall approve construction design and upon completion of installation, certify compliance with the standards and installation practices as specified by this document.

- C. Prior to commencing the work of the section, the contractor shall convene a meeting with Construction Manager, owner's representative, and Engineering Services representative:
  - 1. The meeting will cover Project Specifications, Addendum, Change Orders, IDF layouts, labeling, and other project work, documents and site conditions.
  - 2. System testing procedures and requirements shall be confirmed at this time.
  - 3. Test report forms and schedules shall be provided for Owner review.
  - 4. Inspection milestones will be set and notifications scheduled.
  - 5. Meeting minutes will be distributed and will include agreements, action items and responsible party(s), for this meeting and for future meetings when required.
- D. Store materials and equipment in dry, environmentally controlled space. Do not install equipment and materials until spaces are enclosed, watertight, and dry. Protect equipment from dust and other airborne materials.
- E. Contractor's regular job progress meetings with the Construction Manager and other owner representatives.

# 1.5 SUBMITTALS

- A. Submit shop drawings and/or manufacturer's product data for telecommunications equipment, including termination equipment, copper cables, fiber optic cables, cable routing devices, and associated equipment and materials.
  - 1. Include cut sheets with rated capacities, operating characteristics, electrical characteristics and other measurements and descriptions which describe these items in detail.
- B. Submit manufacturer's test reports and test data for each of the fiber optic cables installed.
  - 1. The test reports must clearly identify which fiber corresponds with the respective test measurement data so that the results can be verified prior to installation of the cable.
- C. Submit a schedule of material and an installation schedule based on the construction schedule and construction phasing, to the Architect/Engineer, within three (3) weeks after contract award.
- D. Submit qualifications data for material installers, supervisors, and the project RCDD (Registered Communications Distribution Designer).
- E. Submit completed cable records, including floor plans, riser diagrams, manhole diagrams, footages on any cable other than horizontal cabling, and jack id's by location.

- F. Submit test reports to the Owner's Representative for approval.
  - 1. Include in the test reports the test data taken and converted values.
  - 2. Prior to submittal for approval, have test reports signed by authorized witnesses present at tests.
  - 3. Submit two (2) final copies of approved test reports to the Owner's representative.
  - 4. No services shall be installed until verified reports are submitted, reviewed, and found to be acceptable by the appropriate Owner's representative.

## 1.6 DELIVERY, STORAGE and HANDLING

- A. Deliver wire and cable properly packaged in factory-fabricated type containers or wound on NEMA-specified type wire and cable reels.
- B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Handle wire and cable carefully to avoid abrading, puncturing, kinking, and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance and characteristic impedance integrity of transmission media are maintained.

## 1.7 SEQUENCING and SCHEDULING

- A. Coordinate with installation of wires/cables, electrical boxes and fittings, cable trays, and raceways.
- B. Sequence installation of optical-fiber cabling systems with other work to minimize possibility of damage during construction.
- C. Where applicable, construction should be performed to minimize downtime of existing data and telephone systems. Necessary downtime must be coordinated with the appropriate UITS representative.

## 1.8 COORDINATION

- A. Coordinate arrangement, mounting, and support of communications 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 pathways, 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 communications 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 Division 07 Section "Penetration Firestopping."

# PART 2 - PRODUCTS

# 2.1 SLEEVES FOR PATHWAYS AND 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.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

# 2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.

- 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
- 3. Pressure Plates: Stainless steel. Include two for each sealing element.
- 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

# 2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

# PART 3 - EXECUTION

- 3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION
  - A. Comply with REA Standards for Engineering, Construction, and Installation; FCC Rules and Regulations, BICSI CO-OSP; ANSI/TIA/EIA-568-B.2-1 Category 6 standard, ANSI/TIA/EIA 569, ANSI/TIA/EIA 607,ANSI/TIA.EIA 758 and other special codes that may apply.
  - 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 communication 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.
  - F. No cable shall be installed in any facilities other than those intended for that use.
    - 1. Gas pipe and water pipes must not be used for conduit under any circumstances.
  - G. Install telecommunication transmission media as indicated, in accordance with manufacturer's written instructions, in compliance with applicable requirements of NEC, and in accordance with recognized industry practices.
  - H. CMP (Plenum) type cable will be used for all telecommunications cables.

- I. Coordinate transmission media installation work, as necessary to properly interface installation of media with other work.
- J. Do not install compressed, kinked, scored, deformed or abraded cable, or allow such damage to occur.
  - 1. Damaged materials shall be removed from the job site immediately.
- K. Use extreme care in handling, fishing, and pulling-in transmission media to avoid damage to conductors, shielding and jacketing/cladding.
  - 1. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips, which will not damage media or raceway.
  - 2. If power equipment is used to pull cable, the pull speed must not exceed 30 meters per minute.
  - 3. Use water-based lubricant approved by the cable manufacturer to ensure manufacturer's pulling tensions are not exceeded.
  - 4. Compound used must not deteriorate conductor or insulation
  - 5. Cable bending radii must not be exceeded.
  - 6. Pulling methods must not cause cable to twist.
  - 7. Cables pulled through pull boxes shall be hand assisted to prevent the cable from being crushed, kinked, or scraped.
- L. Provide pull strings in telecommunication conduit.
  - 1. To facilitate future cable installations, install a nylon pull cord in each conduit simultaneously with the pull-in of cable.
- M. Pull conductors simultaneously where more than one is being installed in same raceway.
- N. Splices in building media runs are NOT permitted.
  - 1. Building wiring must be continuous and undamaged from outlet to connecting block or connecting block to connecting block.
- O. Terminations shall be made with the manufacturer's stated tools and in accordance with manufacturer's instructions and guidelines.
- P. Tighten connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque-tightening values. Where manufacturers torque requirements are not indicated, tighten connectors and terminals to comply with tightening torque specified in UL Std.
- Q. Horizontal Station cables shall be secured with Velcro tywraps. Both Fiber and Copper Entrance and riser cable shall be secured with standard tywraps. Observe the manufacturer's recommendations for distances between tywraps and tightening tension from tywraps and as specified in ANSI/TIA/EIA-568.

R. Comply with Division 07 requirements for Firestopping. Comply with TIA/EIA 569 on Firestopping.

## 3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways, cables, wireways, or cable trays 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 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway 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 pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual pathways 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-inch 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-inch annular clear space between pathway 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 pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

# 3.4 TESTING and DOCUMENTATION

- A. General:
  - 1. Acceptance testing shall be completed and documentation provided to the Owner as soon as possible in order to permit the installation of networking equipment necessary to bring the building online for security and equipment monitoring systems.
- B. Testing:
  - 1. Acceptance testing by the owner shall not occur until all work in the telecommunication closet area is completed, including but not limited to mounting and installation of fiber OSP and riser cables, backboards, terminating boxes and cabinets, and grounding blocks, and termination of fiber riser cables, copper backbone cables, station wires, or any other work necessary for the completion of the installation.
  - 2. The owner shall have the right to schedule acceptance testing at its convenience.
  - 3. An owner representative, at the option of the owner, shall be present during testing.
  - 4. Such acceptance testing shall in no way reduce the Contractors' obligations regarding restoration, cleanup, or warranty.
  - 5. Contractor shall perform tests necessary prior to acceptance testing to ensure that the installed cables will pass acceptance testing performed in conjunction with Owner representatives.
  - 6. Contractor shall be responsible for performing, tracking, and recording the results of tests.
  - 7. Contractor shall be responsible for providing equipment and materials necessary for as long a period of time as necessary to complete testing to the satisfaction of the Owner.
  - 8. Test record forms shall be agreed to by the owner prior to the commencement of acceptance testing.

# C. Documentation:

- 1. Provide record plant documentation, including jack type (Information outlet), jack location, circuit length, fiber riser cable lengths, and copper backbone cable lengths and any other information deemed to be useful.
- 2. The documentation format(s) will be agreed upon between the Owner's Telecommunication Coordinator and the Contractor.
  - a. Provide all documentation in electronic format.
  - b. If it is agreed to use proprietary software to provide testing results, the Contractor will be required to furnish licensed system software to run it unless the owner already has a licensed version of the contractor's software.

# 3.5 RECORD DRAWINGS

- A. Provide updated drawings of telecommunications systems in CAD format.
- B. As a minimum, the data provided must include the following elements:
  - 1. Cable routing.
  - 2. Riser and OSP cable, pair (count), locations, and final cable lengths.
  - 3. Supporting structures.
  - 4. Terminal locations and IDs.
  - 5. Telecommunications Room and terminal details.
  - 6. Conduit and cable tray routing, elevations installed at and section lengths.
  - 7. Pull box locations, elevations installed at and sizes.
  - 8. Information Outlet locations, label ID's, types, and serving Telecommunications Room.
  - 9. For each change reflected on the Record Drawings, the Change Order Request number shall be shown.

## 3.6 WARRANTY

- A. The warranty on labor and material installed by the Contractor shall be in effect for Five (5) years from the date of acceptance of the work.
- B. Contractor shall repair, adjust, and/or replace, whichever the Owner determines to be in its best interests, any defective equipment, materials, or workmanship, as well as such parts of the work damaged or destroyed by such defect, during warranty period, at the Contractor's sole cost and expense.
- C. In the event that any of the equipment specified, supplied, and/or installed as part of the work should fail to produce capacities or meet design specification as published or warranted by the manufacturer of the equipment involved or as specified in this document, the Contractor shall, in conjunction with the equipment manufacturer, remove and replace such equipment with equipment that will meet requirements without additional cost to the Owner.

- D. In the event that the Contractor does not affect repair within seven (7) days from the date of notification of such defect, the owner may secure repair services from other sources and charge the Contractor for such costs without voiding the warranty.
- E. Guarantees of material, equipment, and workmanship running in favor of the Contractor shall be transferred and assigned to the Owner on completion of the work and acceptance of said work by the Owner.

# 3.7 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 27 05 00

# SECTION 27 11 00 – COMMUNICATIONS EQUIPMENT ROOM FITTINGS

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
  - A. Section Includes:
    - 1. Telecommunications mounting elements.
    - 2. Backboards.
    - 3. Telecommunications equipment racks and cabinets.
    - 4. Telecommunications service entrance pathways.
    - 5. Grounding.
  - B. Related Sections:
    - 1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
    - 2. Division 27 Section "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

# 1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches in width.
- C. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- D. LAN: Local area network.
- E. RCDD: Registered Communications Distribution Designer.

F. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

# PART 2 - PRODUCTS

# 2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569.
- B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
  - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
  - 2. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 3. Lacing bars, spools, J-hooks, and D-rings.
  - 4. Straps and other devices.
  - 5. Manufacturers:
    - a. Horizontal Cable Hangers: Panduit J-Pro Series.
- C. Cable Trays:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cable Management Solutions, Inc.
    - b. Cablofil Inc.
    - c. Cooper B-Line, Inc.
    - d. Cope Tyco/Allied Tube & Conduit.
    - e. GS Metals Corp.
  - 2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by hot-dip galvanizing, complying with NEMA VE2 and TIA/EIA -569, Grade 0.55, not less than 0.002165 inch thick.
    - a. Ladder Cable Trays: Size as shown on drawings wide, and a rung spacing of 6 inches.
  - 3. A 12-inch ladder rack shall be installed from the top of the equipment rack to 4' X 8' wall mounted plywood board, as needed or shown on drawings to stabilize equipment racks, and according to room layout and field conditions.

- D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
  - 1. Outlet boxes shall be standard 2 gang box with single gang plaster ring, and 2-1/8 inches deep.

# 2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry." Backboards shall be painted with two coats of fire retardant paint on all sides, or fire retardant treated and painted. Paint color shall be light gray or off white.

# 2.3 EQUIPMENT FRAMES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Equipment Racks: Panduit CMR19x84.
  - 2. Wire Management Vertical 6": Panduit Patchrunner PRV6.
  - 3. Wire Management Hinged Door 6": Panduit PRD6.
  - 4. Wire Management Horizontal: Panduit WMPH2E.
  - 5. Wire Management Intermediate 8": Panduit Patchrunner PRV8.
  - 6. Wire Management Hinged Door 8": Panduit PRD8.
- B. General Frame Requirements:
  - 1. Distribution Frames: Freestanding, 84-inch tall, modular-steel units designed telecommunications terminal support and coordinated with dimensions of units to be supported.
  - 2. Module Dimension: Width compatible with EIA 310 standard, 19-inch panel mounting.
  - 3. Finish: Manufacturer's standard, baked-polyester powder coat.
- C. Floor-Mounted Racks: Modular-type, steel construction.
  - 1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
  - 2. Baked-polyester powder coat finish.
- D. Cable Management for Equipment Frames:
  - 1. Vertical: Open ends of racks shall have 6-inch vertical wire management with hinged doors.
  - 2. Between multiple racks use 8-inch vertical wire managers and hinged doors.

3. Horizontal: On the top and bottom of each rack, install one horizontal wire manager with covers.

# 2.4 GROUNDING

- A. The Building Telecommunication Equipment Room (IDF-1) shall have a Telecomm Main Grounding Bus Bar (TMGB) that is in compliance with J-STD-607, with minimum dimensions of 1/4-inch thick and 4 inches wide, length as required to support current needs and future growth.
  - 1. The Ground Bus Bar shall be mounted with stand-off insulators that comply with UL 891 for use in switchboards, 600V, made of Lexan or PVC impulse tested at 5000V.
  - 2. Mount the Ground Bus Bar with a minimum of 2 inches of clearance behind the bar.
  - 3. Provide a solid or stranded copper wire building earth ground bonded to the electric power ground from the Grounding bus bar in the Building Telecommunication Equipment Room (IDF-1).
  - 4. Connections to the TMGB shall be made with exothermic welding or two-hole compression lugs with a two-crimp minimum.
  - 5. The busbar shall be cleaned and have antioxidant applied before attaching grounding conductors.
  - 6. The TMGB shall be bonded to any electrical panelboards that occupy the same room using a minimum #6 AWG copper conductor with a maximum length of 13 feet.
  - 7. All ungrounded telecommunications racks and metallic raceways in the same room as the TMGB shall be bonded to the TMGB.
  - 8. The TMGB shall be bonded the building ground system ground or building structural steel.
  - 9. The TMGB shall be grounded to the Floor Telecommunication Equipment Rooms (IDF-2's) Telecommunications Grounding Bus bars (TGBs), forming the Telecommunications Bonding Backbone (TBB) with copper ground wire solid or stranded, insulated or uninsulated, according to length, as detailed in J-STD-607, shown below:

## WIRE LENGTH WIRE SIZE (AWG)

6
4
3
2
1
1/0
2/0
3/0

10. The TMGB shall be bonded to the Alternating Current Electrical Ground (ACEG) with a copper ground wire of not smaller gauge than that used for the TBB.

- B. Each Floor Telecommunication Equipment Room (IDF-2) shall be equipped with a Telecommunications Grounding Bus bar (TGB that is in compliance with J-STD-607, with minimum dimensions of 1/4-inch thick and 2 inches wide, length as required to support current needs and future growth).
  - 1. All ground wires shall be continuous and un-spliced between Equipment Room grounding bus bars.
  - 2. Locate grounding bus bars to minimize ground wire lengths; location shall be coordinated with Owner Information Technology Services representative and Owner electrical engineer.
  - 3. The TGB shall be bonded to any electrical panelboards that occupy the same room using a minimum #6 AWG copper conductor with a maximum length of 13 feet.
  - 4. All ungrounded telecommunications racks and metallic raceways in the same room as the TMGB shall be bonded to the TGB.
- C. In high rise buildings with multiple Telecommunications Rooms per floor, the top floor TGB's and every 3rd floor TGB's shall be bonded together with the same size grounding conductor used in the grounding riser system (TBB).
- D. Telecommunications cables with metallic sheath members shall be bonded together at splices with a #6 solid or stranded copper ground wire and bonded to the TMGB or TGB.
  - 1. Cable sheaths shall be grounded to a tested and proven earth ground within 50 feet of entering any building with an independent #6 solid or stranded copper ground wire or other electrically equivalent method as approved by the Owner.
- E. Test reports shall include the results of ground testing performed according the electrical system ground testing requirements.

# PART 3 - EXECUTION

# 3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

# 3.2 EQUIPMENT RACKS

A. Equipment racks shall be anchored to the floor and braced overhead with ladder racking and grounded to ground bus bar location in the IDF with a #6 solid or stranded ground wire.

B. Install underground entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems"

# 3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

# 3.4 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

## END OF SECTION 27 11 00

# SECTION 27 15 00 – COMMUNICATIONS HORIZONTAL CABLING

# PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
  - A. Section Includes:
    - 1. Pathways.
    - 2. UTP cabling.
    - 3. Multiuser telecommunications outlet assemblies.
    - 4. Cable connecting hardware, patch panels, and cross-connects.
    - 5. Telecommunications outlet/connectors.
    - 6. Cabling system identification products.
    - 7. Cable management system.
  - B. Related Sections:
    - 1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
    - 2. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

## 1.3 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.
- D. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

- F. EMI: Electromagnetic interference.
- G. IDC: Insulation displacement connector.
- H. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- I. LAN: Local area network.
- J. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- K. RCDD: Registered Communications Distribution Designer.
- L. Solid-Bottom or Non-Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom without ventilation openings.
- M. Trough or Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom having openings for the passage of air.
- N. UTP: Unshielded twisted pair.

## 1.4 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
  - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
  - 2. Bridged taps and splices shall not be installed in the horizontal cabling.
  - 3. Splitters shall not be installed as part of the optical fiber cabling.
- B. A work area is approximately 100 sq. ft. and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

# 1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

## 1.6 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. Patch-Panel Units: One of each type.
  - 2. Connecting Blocks: One of each type.
  - 3. Device Plates: One of each type.
  - 4. Multiuser Telecommunications Outlet Assemblies: One of each type.

# PART 2 - PRODUCTS

# 2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 2. Lacing bars, spools, J-hooks, and D-rings.
  - 3. Straps and other devices.
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
  - 1. Outlet boxes shall be no smaller than 2 gang boxes with single gang plaster ring, and 2-1/8-inches deep.

## 2.2 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Belden CDT Inc.
  - 2. Berk-Tek; a Nexans company.
  - 3. CommScope, Inc.
  - 4. Mohawk.

- 5. Superior Essex Inc.
- 6. General Cable.
- B. All cable shall be plenum rated.
- C. Cable jacket color shall be blue.
- D. Rating: All horizontal cabling shall be cat 6A.

# 2.3 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Panduit Corp.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
  - 1. Number of Terminals per Field: One for each conductor in assigned cables.
  - 2. Unshielded Twisted Pair Risers.
    - a. Amphenol style cables shall be terminated on 110 type blocks with 110A wiring blocks.
    - b. Terminal blocks shall be located so as to be easily cross-connected to feeder pair and the voice cable stations and plugged into the analog voice panel.
    - c. Manufacturers:
      - 1) Copper backbone termination: Block Panduit Pan-Punch 110 Category 6 system.
- D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
  - 1. Number of Jacks per Field: One for each four-pair UTP cable indicated.
  - 2. Use Panduit modular 6 port face plate angled patch panels filled with orange TX-6+ modules.
  - 3. Use a Panduit voice panel installed in the rack for analog voice with a 50 pin, 25 pair female amphenol connector.
  - 4. Manufacturers:
    - a. Horizontal Copper Cabling Patch Panel: Panduit CPPLA24WBLY 24 port with CFPLM6BL's installed.

- b. Patch panel jack modules: Panduit CJ688TGYL TX6 PLUS, orange.
- c. Voice Patch Panel: Panduit VP24382TV25Y with RJ21 connector.
- E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- F. Patch Cords: The Owner will provide all patch cords.

# 2.4 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Manufacturers:
  - 1. Faceplate: Panduit CFPE4IWY Executive series, number of ports as shown on drawings, off-white faceplate
  - 2. Jack module: Panduit CJ688TGYL Mini-com TX-6+ module, orange.
  - 3. Blank module: Panduit CMBIW-X Mini-Com blank module insert, off-white.

# 2.5 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

## PART 3 - EXECUTION

## 3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with Owner.

## 3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

# 3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 3 inches above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

## 3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Station Cabling:
  - 1. 4-pair UTP cables should withstand 25 foot-pounds of pulling pressure. This number shall be verified by the wire manufacturer.
  - 2. Maximum cable length is limited to 90 meters (295 feet) from the jack to the patch panels.

- 3. Comply with ANSI/TIA/EIA-569 standard regarding the requirements and recommendations for separation of copper telecommunication cabling from sources of electromagnetic interference.
- 4. The Contractor shall replace any damaged cable at no expense to the Owner. No repair will be allowed on damaged cables.
- 5. Cabling shall be terminated at the station jack and at the equipment room as indicated in ANSI-TIA-EIA-568, wiring configuration T568A.
- 6. The modular faceplate at the user end shall be equipped with inserts for communication services as indicated on plans.
- 7. Station cable in the IDF shall be terminated on Category 6 patch panel located in the equipment racks.
- 8. The minimum bend radius of Category 6 UTP cable shall not be smaller than four (4) times the diameter of the jacketed cable and shall not cause the cable jacket to buckle.
- 9. Route cables from the back of the patch panel through its coupler openings and loosely attach them to the wire manager with velcro cable ties, leaving enough slack for retermination at a future date.
- 10. Remove only as much jacketing as needed to terminate properly to the connecting hardware, keeping the amount of jacketing removed to an absolute minimum.
- 11. Do not untwist pairs more than 0.5 inches.
- 12. Visually *inspect* cable pairs for bare wire and other defects before terminating wires.
- 13. Once all of the cables have been terminated, dress the cable slack behind the panel with velcro tie wraps tightened to a snug but not compressing fit.
- 14. Telecommunication cabling for elevator emergency phones shall be provided as follows:
  - a. Cabling for the elevator telephone to the elevator control room is by the elevator installer.
  - b. Cabling from the elevator control room to the telecommunication equipment room is by the electrical contractor.
- C. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  - 2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- D. Group connecting hardware for cables into separate logical fields.
- E. Separation from EMI Sources:
  - 1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

- 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
- 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
- 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 1 inch.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
- 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
- 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

# 3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

## 3.6 IDENTIFICATION

- A. Cable and Wire Identification:
  - 1. Information Outlet receptacles, cables, and terminations shall be labeled with a standard identification tag at both the Information Outlet and on the jackfields in the IDF/Wire Closet.
    - a. Tags shall be preprinted or computer printed with indelible water proof ink and mechanically secured in a permanent fashion; for example, such as using an appropriate label maker with 3/8" tape.

- b. Handwritten labels are NOT acceptable.
- c. Labels shall be mounted in a manner which permits easy access and viewing.
- d. The station cable serving each receptacle must be labeled at the room receptacle and the IDF rack.
- 2. Information Outlet receptacles in rooms are to be labeled -A through -ZZ in each room beginning with the first receptacle to the left of the main entrance to the room and continuing clockwise around the room.
  - a. All labeling will be done in all capital letters.
  - b. For example, a jack labeled 246A-A would be because:
    - 1) Room 246A is the room number.
    - 2) The Information Outlet designation is "A" (first receptacle in room from the left of the door).
    - 3) Station cables from a given room shall be terminated in sequential order, i.e. 246A-A, 246A-B, 246A-C, 246A-D, etc.
- 3. Information Outlets for special purposes shall have a unique identifier listed with the jack ID:
  - a. The identifier shall be inserted into the Outlet ID, between the room number and the Outlet designator as indicated in following drawings.
  - b. Common identifiers are list below:
    - 1) Wireless access point (WAP) "100+WD-A".
    - 2) Ademco alarm jack "100+AD-A".
    - 3) ATM jack "100+ATM-A".
    - 4) Elevator jack "100+EL-A".
    - 5) Emergency phone "100+EM-A".
    - 6) Card Reader "100+CR-A".
    - 7) Lighting Systems Controls "100+DS-A".
- 4. All labeling shall be coordinated with and approved by appropriate Owner Representative.
  - a. Schedule a meeting with the owner representative prior to the permanent labeling of Information Outlets and IDF patch panels.

# 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.

- C. Tests and Inspections:
  - 1. Perform visual inspection to insure that all cables are terminated on the eight position station jacks on both ends in proper color code order.
  - 2. All station cables attached between station jacks and floor equipment room patch panels and punch down blocks will be link tested with a cable analyzer to insure compliance with current ANSI/TIA/EIA-568.
  - 3. All pairs shall test good and meet Category 6 parameters.
    - a. Open, split, miss-terminated pairs, deviations from the manufacturer's installation specifications, defective connections and bad installation practices will not be accepted and must be corrected.
  - 4. Test 100% of station wire in both directions with a certified handheld tester, such as the Fluke OmniScanner or the Fluke DSP 4000 and other test equipment as necessary to assure proper termination sequences, continuity, and Category 6 compliance. Station wire shall have NO bad pairs.
  - 5. When all station wire is determined to be acceptable, Owner will spot test the plant using a certified handheld tester, such as the Fluke OmniScanner or Fluke DSP 4000.
  - 6. Test results shall meet or exceed the appropriate tests requirements as specified in the ANSI/TIA/EIA-568 specifications.
  - 7. The approved handheld tester will have the capability to be programmed with current Category 6 requirements as specified in ANSI/TIA/EIA-568 standards.
  - 8. Documentation will include cable ID (same as jack ID) to be marked on the punch down blocks and patch panels in the telecommunication closet, station jack ID to be marked on the station jack and results of the testing done with the cable analyzer.
  - 9. Analyzer documentation will need to be in the "csv" or "dat" format that can be read by Fluke's "Linkware" software.
  - 10. Results must be labeled using the information outlet labeling scheme for the project.
  - 11. Test results shall be stored on a CD and delivered to the Owner.
  - 12. Test results shall be verified by the designated owner personnel as part of the inspection and acceptance procedure.
- D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- F. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- G. Test results shall be stored on a CD and delivered to the owner representative.
H. Test results shall be verified by the designated owner personnel as part of the inspection and acceptance procedure.

END OF SECTION 27 15 00

## SECTION 27 41 33 - MASTER ANTENNA TELEVISION SYSTEM

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Provide new master antenna television system.
  - 2. Broadband coaxial cabling for distributing television signal to interface points.

## 1.3 DEFINITIONS

- A. Broadband: For the purposes of this Section, wide bandwidth equipment or systems that can carry signals occupying in the frequency range of 54 to 1002 MHz. A broadband communication system can simultaneously accommodate television, voice, data, and many other services.
- B. Carrier: A pure-frequency signal that is modulated to carry information. In the process of modulation, it is spread out over a wider band. The carrier frequency is the center frequency on any television channel.
- C. CATV: Community antenna television; a communication system that simultaneously distributes several different channels of broadcast programs and other information to customers via a coaxial cable.
- D. dBmV: Decibels relative to 1 mV across 75 ohms. Zero dBmV is defined as 1 mV across 75 ohms. dBmV = 20 log  $10(V_1/V_2)$  where  $V_1$  is the measurement of voltage at a point having identical impedance to  $V_2$  (0.001 V across 75 ohms).
- E. Headend: The control center of the master antenna television system, where incoming signals are amplified, converted, processed, and combined into a common cable along with any locally originated television signals, for transmission to user-interface points. It is also called the "Central Retransmission Facility."
- F. MATV: Master antenna television; a small television antenna distribution system usually restricted to one or two buildings.

- G. RF: Radio frequency.
- H. User Interface: End point of Contractor's responsibility for Work of this Section. User interfaces are the 75-ohm terminals on device plates.

## 1.4 SYSTEM DESCRIPTION

- A. System shall consist of s new coaxial cable distribution system.
- B. Headend equipment shall be provided by the contractor.
- C. Cable distribution system consisting of coaxial cables and required hardware complying with IEEE 802.7 and resulting in performance parameters specified in this Section.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for television equipment.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. For coaxial cable, include the following installation data for each type used:
    - a. Nominal OD.
    - b. Minimum bending radius.
    - c. Maximum pulling tension.
- C. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add testing record of each piece of adjustable equipment, listing name of person testing, date of test, and description of as-left set points.
- D. Field quality-control test reports.

## 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NECA 1.
- C. Comply with NFPA 70.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: System components shall be equipped and rated for the environments where installed.
- 1.8 COORDINATION
  - A. Coordinate size and location of raceway system, and provisions for electrical power to equipment of this Section.

#### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

#### 2.2 MATV EQUIPMENT

A. The contractor will furnish and install the necessary amplification equipment, splitters and isolation taps for the television system.

## 2.3 DISTRIBUTION COMPONENTS

- A. Provide the types of connectors, mounting frames, faceplates, wall plates, and boxes indicated in the following paragraphs for system outlets and inputs. Provide connectors, frame and plates shall be of the types and quantities for each outlet and input as indicated in this Section and on the Drawings. The catalog numbers used constitute the type and quality of equipment shall be provided. Hubbell, Leviton, Ortronics, Panduit, and Siemon are approved manufacturers for the specified equipment unless otherwise indicated.
- B. User-Interface Device: Flush, female-type outlets for mounting in standard outlet box, consisting of the following:
  - 1. Broadband RF Connector Module: "F" type coaxial feed-through connector on modular plate. Color shall be <u>white</u>. Connector shall be Panduit #CMFWH or approved equal.
  - 2. Faceplates: Single-gang faceplate with single modular jack opening. Plate color shall be <u>white</u>. Plate shall be Panduit #CFP1WH or approved equal. Provide one (1) plate for each outlet of the types indicated.

- 2.4 CABLES
  - A. Manufacturers:
    - 1. Alpha Wire Company.
    - 2. Belden Inc.; Electronics Division.
    - 3. CommScope Properties, LLC.
    - 4. General Cable.
    - 5. Helix/HiTemp Cables, Inc.; Draka USA.
    - 6. Superior Essex.
    - 7. West Penn Wire/CDT; a division of Cable Design Technologies, Inc.
  - B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband MATV applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB minimum from 7 to 806 MHz, and shall be listed to comply with NFPA 70, Articles 810 and 820.
  - C. RG-6/U, Plenum-Rated Indoor Distribution Cable: No. 16 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation. Double shielded with 100 percent aluminum-foil shield, 65 percent aluminum braid. Copolymer jacket. NFPA 70, Type CATV and UL 910.

## 2.5 CABLE CONNECTORS

- A. Manufacturers:
  - 1. Amphenol Corporation.
  - 2. B&L Coaxial Connections, Ltd.
  - 3. Connect-Tech Products.
  - 4. Ideal industries.
  - 5. Kings-Win.
  - 6. Leviton Voice & Data Division.
- B. MATV Coaxial Cable Connectors: Type F, 75 ohms.

## 2.6 SOURCE QUALITY CONTROL

A. Cable products shall be sweep tested at the factory before shipping at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine pathway elements intended for coaxial cable installation. Check raceways, cables, trays, and other elements for compliance with accessibility for installation and maintenance, and other conditions affecting installation.
- B. Examine walls, floors, roofs, equipment bases, and roof supports for suitable conditions where television equipment is to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 GENERAL WIRING

- A. Wiring Method: Install cables in raceways except in accessible indoor ceiling spaces, attics, and as otherwise indicated. Conceal raceways and wiring except in unfinished spaces.
- B. Wiring Method: Install cables concealed in accessible ceilings, walls, and floors where possible.
- C. Wiring Within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- D. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- E. Grounding: According to recommendations in IEEE 142 and IEEE 1100.

## 3.3 COAXIAL CABLE INSTALLATION

- A. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps may not be used for heating.
- B. Cable may not be installed in same raceway with power cable.
- C. Coaxial cable shall not be spliced except on plywood backboards in wire closets, or in cabinets designated for the purpose.
- D. Outdoor connections shall be installed in enclosures meeting NEMA 250, Type 4X. Connectors shall be corrosion resistant with properly designed O-rings to keep out moisture.
- E. Do not use water-based cable pulling lubricants with PVC-jacketed cable.

- F. Do not exceed manufacturer's recommended minimum bending radiuses
- G. Pulling Cable: Do not exceed manufacturer's recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
- H. Exposed Cable: Install parallel to building lines, follow surface contours, and support cable according to manufacturer's written instructions. Do not run adjacent and parallel to power or data cables.
- I. Cable Support: Install supports at intervals recommended in writing by cable manufacturer. Install supports within 6 inches (150 mm) of connector so no weight of cable is carried by connector. Use no staples or wire ties, pull tie-wrap snug, and do not over tighten.

## 3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."

END OF SECTION 27 41 33

# DIVISION 28

# SECTION 28 05 00 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

# 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. Electronic safety and security equipment coordination and installation.
  - 2. Sleeves for raceways and cables.
  - 3. Sleeve seals.
  - 4. Grout.
  - 5. Common electronic safety and security installation requirements.

## 1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

## 1.4 SUBMITTALS

A. Product Data: For sleeve seals.

## 1.5 COORDINATION

- A. Coordinate arrangement, mounting, and support of electronic safety and security 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 electronic safety and security 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 Division 07 Section "Penetration 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.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

# 2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. 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.
  - 3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

# PART 3 - EXECUTION

- 3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY 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 electronic safety and security 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 ELECTRONIC SAFETY AND SECURITY PENETRATIONS

- A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays 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 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch 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 Division 07 Section "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 Division 07 Section "Penetration 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-inch 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-inch 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 electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping

materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 28 05 00

# SECTION 28 05 13 – CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

## 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. Low-voltage control cabling.
    - 2. Control-circuit conductors.
    - 3. Fire alarm wire and cable.
    - 4. Identification products.

## 1.3 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- G. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- H. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- I. RCDD: Registered Communications Distribution Designer.

- J. Solid-Bottom or Non-Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.
- K. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.
- L. UTP: Unshielded twisted pair.

# 1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

# PART 2 - PRODUCTS

## 2.1 PATHWAYS

- A. Support of Open Cabling: NRTL labeled for support of fire alarm cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 2. Lacing bars, spools, J-hooks, and D-rings.
  - 3. Straps and other devices.
- B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
  - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

# 2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

# 2.3 LOW-VOLTAGE CONTROL CABLE

- A. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
  - 1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with NFPA 262.

# 2.4 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, power-limited cable, concealed in building finishes complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.
- 2.5 FIRE ALARM WIRE AND CABLE
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. Comtran Corp.
    - 2. Draka USA.
    - 3. Genesis Cable Products; Honeywell International, Inc.
    - 4. Rockbestos-Suprenant Cable Corporation.
    - 5. West Penn Wire/CDT; a division of Cable Design Technologies.
  - B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
  - C. Signaling Line Circuits: Twisted, shielded pair, not less than size as recommended by system manufacturer.
    - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
  - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
  - 2. Line-Voltage Circuits: No. 12 AWG, minimum.

# 2.6 IDENTIFICATION PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Brady Corporation
  - 2. HellermannTyton.
  - 3. Kroy LLC.
  - 4. Panduit Corp.
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

## PART 3 - EXECUTION

## 3.1 INSTALLATION OF PATHWAYS

- A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.
- B. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

# 3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
  - 2. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

- 3. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
- 4. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

# 3.3 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems."
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

## 3.4 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
  - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
  - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
  - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

# 3.5 CONNECTIONS

A. Comply with requirements in Division 28 Section "Fire Detection and Alarm" for connecting, terminating, and identifying wires and cables.

## 3.6 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

## 3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

END OF SECTION 28 05 13

# SECTION 28 31 11 – DIGITAL, ADDRESSABLE FIRE ALARM SYSTEM

## 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 an new addressable type fire alarm system.

## 1.3 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

#### 1.4 SYSTEM DESCRIPTION

A. Non-coded, analog-addressable system; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

## 1.5 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72.
- B. Fire alarm signal initiation shall be by one or more of the following devices:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Smoke detectors.
  - 4. Verified automatic alarm operation of smoke detectors.
  - 5. Automatic sprinkler system water flow.

- C. Fire alarm signal shall initiate the following actions:
  - 1. Alarm notification appliances shall operate continuously.
  - 2. Identify alarm at the FACP and remote annunciators.
  - 3. De-energize electromagnetic door holders.
  - 4. Transmit an alarm signal to the remote alarm receiving station.
  - 5. Unlock electric door locks in designated egress paths.
  - 6. Release fire and smoke doors held open by magnetic door holders.
  - 7. Shut off heating, ventilating, and air-conditioning equipment.
  - 8. Close smoke dampers in air ducts of system serving zone where alarm was initiated.
  - 9. Record events in the system memory.
- D. Supervisory signal initiation shall be by one or more of the following devices or actions:
  - 1. Operation of a fire-protection system valve tamper.
- E. System trouble signal initiation shall be by one or more of the following devices or actions:
  - 1. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
  - 2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
  - 3. Loss of primary power at the FACP.
  - 4. Ground or a single break in FACP internal circuits.
  - 5. Abnormal ac voltage at the FACP.
  - 6. A break in standby battery circuitry.
  - 7. Failure of battery charging.
  - 8. Abnormal position of any switch at the FACP or annunciator.
  - 9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
  - 10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- F. System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP and remote annunciators. Record the event on system printer.

## 1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Shop Drawings shall be prepared by persons with the following qualifications:
    - a. Trained and certified by manufacturer in fire alarm system design.

- 2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
- 3. Device Address List: Coordinate with final system programming.
- 4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
- 5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
- 6. Batteries: Size calculations.
- 7. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
- 8. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
- 9. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- C. Qualification Data: For Installer.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.
- F. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

# 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Work of this Section be performed by a UL-listed company.
- 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.

# 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
  - 2. Smoke, Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
  - 3. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
  - 4. Keys and Tools: One extra set for access to locked and tamper-proofed components.
  - 5. Audible and Visual Notification Appliances: One of each type installed.
  - 6. Fuses: Two of each type installed in the system.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. FACP and Equipment:
    - a. SimplexGrinnell
    - b. Siemens
    - c. Fire Lite
  - 2. Wire and Cable:
    - a. Comtran Corporation.
    - b. Helix/HiTemp Cables, Inc.; a Draka USA Company.
    - c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
    - d. West Penn Wire/CDT; a division of Cable Design Technologies.

## 2.2 FACP

- A. General Description:
  - 1. Modular, power-limited design with electronic modules, UL 864 listed.
  - 2. Addressable initiation devices that communicate device identity and status.
    - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at the FACP.

- b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
- 3. Addressable control circuits for operation of mechanical equipment.
- 4. Capacity: system shall be capable of supporting number of devices shown on the plans plus 25% future devices.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
  - 1. Annunciator and Display: Liquid-crystal type, two line(s) of 80 characters, minimum.
  - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands; and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- C. Circuits:
  - 1. Signaling Line Circuits: NFPA 72, Class B.
    - a. System Layout: Install no more than 80% capacity addressable devices on each signaling line circuit.
  - 2. Notification-Appliance Circuits: NFPA 72, Class B.
  - 3. Actuation of alarm notification appliances, annunciation, shall occur within 10 seconds after the activation of an initiating device.
  - 4. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.
- D. Smoke-Alarm Verification:
  - 1. Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
  - 2. Record events by the system printer.
  - 3. Sound general alarm if the alarm is verified.
  - 4. Cancel FACP indication and system reset if the alarm is not verified.
- E. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.

- F. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciators, after initiating devices are restored to normal.
  - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
  - 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
  - 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- G. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a print-out of the final adjusted values on the system printer.
- I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.
- J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory and digital alarm communicator transmitter shall be powered by the 24-V dc source.
  - 1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
  - 2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."
- K. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
  - 1. Batteries: Sealed lead calcium.
  - 2. Battery and Charger Capacity: Comply with NFPA 72.
- L. Surge Protection:
  - 1. Install surge protection on normal ac power for the FACP and its accessories. Comply with Division 26 Section "Transient Voltage Suppression" for auxiliary panel suppressors.

- 2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.
- M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

# 2.3 MANUAL FIRE ALARM BOXES

- A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.
  - 1. Single-action mechanism, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
  - 2. Station Reset: Key- or wrench-operated switch.
  - 3. Provide protective plastic covers over all manual pull stations accessible to patients.

# 2.4 SYSTEM SMOKE DETECTORS

- A. General Description:
  - 1. UL 268 listed, operating at 24-V dc, nominal.
  - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
  - 3. Multipurpose type, containing the following:
    - a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
    - b. Heat sensor, combination rate-of-rise and fixed temperature.
  - 4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
  - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  - 6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and poweron status.
  - 7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
    - a. Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F per minute.

- b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F.
- c. Provide multiple levels of detection sensitivity for each sensor.
- 8. Provide relay modules for all smoke detectors located in the patient rooms for interface to nurse call system.
- B. Photoelectric Smoke Detectors:
  - 1. Sensor: LED or infrared light source with matching silicon-cell receiver.
  - 2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
- C. Remote Air-Sampling Detector System: Includes air-sampling pipe network, a laser-based photoelectric detector, a sample transport fan, and a control unit.
  - 1. UL 268 listed, operating at 24-V dc, nominal.
  - 2. Pipe Network: Electrical metallic tubing connects control unit with designated sampling holes.
  - 3. Smoke Detector: Particle-counting type with continuous laser beam. Sensitivity adjustable to a minimum of three preset values.
  - 4. Sample Transport Fan: Centrifugal type, creating a minimum static pressure of 0.05-inch wg (12.5 Pa) at all sampling ports.
  - 5. Control Unit: Single or multizone unit as indicated. Provides same system power supply, supervision, and alarm features as specified for the central FACP plus separate trouble indication for airflow and detector problems.
  - 6. Signals to the Central FACP: Any type of local system trouble is reported to the central FACP as a composite "trouble" signal. Alarms on each system zone are individually reported to the central FACP as separately identified zones.
- D. Duct Smoke Detectors:
  - 1. Photoelectric Smoke Detectors:
    - a. Sensor: LED or infrared light source with matching silicon-cell receiver.
    - b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
  - 2. UL 268A listed, operating at 24-V dc, nominal.
  - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
  - 4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.

- a. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
- 5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
- 6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and poweron status.
- 7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
- 8. Each sensor shall have multiple levels of detection sensitivity.
- 9. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
- 10. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

# 2.5 NOTIFICATION APPLIANCES

- A. Description: Equipped for mounting as indicated and with screw terminals for system connections.
  - 1. Combination Devices: Factory-integrated audible and visible devices in a singlemounting assembly.
- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn.
- C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
  - 1. Rated Light Output: Multi candela.
  - 2. Strobe Leads: Factory connected to screw terminals.

# 2.6 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

## 2.7 WIRE AND CABLE

A. Wire and cable for fire alarm systems shall be UL listed, plenum rated and labeled as complying with NFPA 70, Article 760.

- B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
  - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70 Article 760, Classification CI, for power-limited fire alarm signal service. UL listed as Type FPL, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
  - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
  - 2. Line-Voltage Circuits: No. 12 AWG, minimum.

## PART 3 - EXECUTION

## 3.1 EQUIPMENT INSTALLATION

- A. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
- B. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.
- C. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- D. Audible Alarm-Indicating Devices: Install +80" A.F.F. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- E. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- F. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.
- G. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

## 3.2 WIRING INSTALLATION

- A. Install wiring according to the following:
  - 1. NECA 1.
  - 2. TIA/EIA 568-A.
- B. Wiring Method:
  - 1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.

- 2. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is not permitted.
- 3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.
- 4. Wiring shall be installed in conduit down walls or under floors. All other installations may be without conduit. Use plenum cable in environmental air spaces, including plenum ceilings. Conceal cables and raceways except in unfinished spaces. Route exposed cables at right angles to building structure and support in neat manner.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

# 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."
- B. Install instructions frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label "FIRE ALARM."

## 3.4 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

# 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
  - 2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
    - a. Include the existing system in tests and inspections.
  - 3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
  - 4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
    - a. Detectors that are outside their marked sensitivity range shall be replaced.
  - 5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

## 3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

## 3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 28 31 11