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# **MARCH 2016**

SPECIFICATIONS FOR

# GENERAL CONSTRUCTION OF NORTH STAR FAMILY DENTISTRY

AT

# NC HIGHWAY 135 MAYODAN, NC

**CIVIL ENGINEER** 

WILSON ENGINEERING GROUP 107 EAST DAVIS STREET SMITHFIELD, NC 27577 TELE: 336-308-9613

STRUCTURAL ENGINEER

MIKE N. WAGONER, P.E. 4921 FOX CHASE ROAD GREENSBORO, NC 27410 TELE: 336-430-6684 MECHANICAL ENGINEER

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#### PROPOSAL FORM

#### GENERAL CONTRACT SINGLE PRIME CONTRACT

#### NORTH STAR FAMILY DENTISTRY HIGHWAY 135 MAYODAN. NORTH CAROLINA

DATE:

TO: North Star Family Dentistry NC Highway 135 Mayodan, NC Addendum Received No. 1..... No. 2.....

#### GENTLEMEN:

The Undersigned, as bidder, declares that he has visited the site and having a clear knowledge of existing facilities and conditions under which work must be performed, and having carefully examined the accompanying Contract Documents, proposes and agrees if this proposal is accepted, to furnish all labor, materials, equipment and services necessary to complete the entire work of the General Contract, Single Prime for the North Star Family Dentistry.

#### COMPLETION OF THE WORK

If Undersigned is notified of Proposal acceptance within thirty (30) days from Proposal Date, he agrees to execute a Contract for above work for below stated Compensation, in the form of American Institute of Architects Standard Agreement. Undersigned agrees to complete the work in\_\_\_\_\_ Calendar days if he is awarded Contract.

#### STIPULATED SUM

The undersigned proposes to furnish labor, materials, equipment and appliances required by said documents for a stipulated sum of:

\_/100 dollars

\$\_\_\_\_\_

The above amount includes all taxes, freight, and installation.

UNIT COST:

In the event work beyond that shown or described on Contract Documents is required, the below stated unit cost shall become the basis for payment for approved additional work:

Α.	Removal in open excavations, rock below grade.	cost per cu. yd. \$
B.	Removal in trenches, rock below grade.	cost per cu. yd. \$
C.	Removal of unsuitable soil & replace	cost per cu. yd. \$

# STIPULATED SUM FOR PRIME SUB-CONTRACTS

PLUMBING CONRACT \$	
	CONTRACTOR
HVAC CONTRACT \$	
	CONTRACTOR
ELECTRICAL CONTRACT \$	
_	CONTRACTOR
 BIDDER	CONTRACTOR'S STATE LICENSE NO.
AGENT	ADDRESS

# **DIVISION 1**

#### **GENERAL CONDITIONS**

#### **1A0 GENERAL CONDITIONS**

The General Conditions of the American Institute of Architects, AIA Document A201-1997, and AIA Document A701-1997, Instructions to Bidders, are hereby made a part of these specifications by reference and shall bind all parties to the Contract as fully as if printed and bound herein.

These documents thoroughly explain the relationship between the Architect, Owner, and Contractor, and both Owner and Contractor should familiarize themselves with same. A copy of the General Conditions is on file at the office of the Architect and may be examined there.

Where any article of the General Conditions is supplemented by; the various sections of these specifications, only such specific articles shall be deemed to be affected, and the balance shall remain in full force and effect.

### 1A1 SUPPLEMENTARY GENERAL CONDITIONS

- OWNER: Dr. Herbert Lewis 201 N. Dalton Street Madison, North Carolina 27025
- SITE LOCATION: NC Highway 135 Mayodan, North Carolina
- CONTRACTOR: Where the term "Contractor" is used herein, it refers to the <u>PRIME</u> Contractor. He will be responsible to the OWNER or Owners representative for the compliance of subcontractors under his award.
- ARCHITECT: Where the term "Architect" is used herein, it refers to Paul Briggs, Architect, 11500 NC Highway 8 Suite C, Lexington, North Carolina.

# **GENERAL INSTRUCTIONS:**

#### PROPOSALS

Each bidder must submit a proposal on the blank form herewith provided. The bidder shall sign his proposal correctly. Proposals may be rejected if they show any omissions, alterations of form, additions not called for, conditional bid, or any irregularities of any kind.

Each proposal must be submitted in a sealed envelope, so marked as to indicate its contents without being opened and delivered the office of Dr. Herbert Lewis at 201 N. Dalton Street, Madison NC.

No bid may be withdrawn for a period of 30 days after the scheduled time for receiving bids.

All bidders must be fully licensed as may be applicable, by the state of North Carolina and the license number indicated on the envelope enclosing the proposal.

Proposals will be opened privately and promptly read on the hour and on the date set in the Invitation.

# VISIT TO THE SITE

Before presenting proposal each Contractor shall visit the site and become familiar with conditions that affect his work and make allowance for such conditions in the proposal. No allowance will subsequently be made for negligence or error in this connection.

#### <u>ADDENDA</u>

Any addenda issued during the time of bidding shall be covered in the proposal and, in closing the contract; they shall become a part thereof.

### INSURANCE

The Contractor shall take out and maintain Public Liability Insurance in the amount of not less than \$1,000,000 for the injuries including accidental death, to any one person and subject to the same limit for each person, in any amount not less than \$1,000,000 on account of one accident and Property Damage Insurance in the amount of not less than \$500,000. He shall also carry Workmen's Compensation and Builder's Risk with extended coverage.

#### CERTIFICATE OF INSURANCE

Before beginning work the Contractor must furnish to Owner a satisfactory proof of carriage of insurance required.

# COMMENCEMENT AND COMPLETION

The dates for commencement and completion of this contract are to be agreed upon between the Owner and the Contractor before signing of the Contract, unless stated otherwise in the proposal.

#### BRAND NAMES

The name of certain brand, make or manufacturer where used in these specifications is intended to set forth and convey to prospective bidders the general style, type, character and quality of article desired, and is not intended to restrict bidders to the specific brand, make or manufacturer named. However, specific functions available in the specific articles shall be provided and the clear indication of any of these substitutions shall be made a part of this proposal.

# PERMITS

Contractor must obtain and pay for all permits, fees, legal notices, etc., in connection with all phases of work under this contract. (Erosion Control, Driveway and Zoning Permits excluded)

#### **SPECIFICATIONS**

In an effort to make specifications more concise and easily read, sentence, sentence structure has been disregarded and instructions and descriptions are given in outline form. Mention in the specifications and/or indication on drawings require that the materials be furnished and labor performed by the Contractor to construct the project in complete accord with the intent of the Plans and Specifications.

Specifications are sub-divided into trades to facilitate the work. The Contractor, however, will be required to furnish all labor and materials necessary to complete the work and is responsible for the work called for under various headings.

Imperative language of the technical sections is directed at the Contractor, unless specifically noted otherwise.

Terms such as "Provide" shall mean: furnish and install, complete, in place and ready for operation and use.

### **CORRELATION**

Should specifications disagree in themselves, the better quality or greater quantity of work or material shall be shall be furnished, unless otherwise ordered in writing. These specifications/drawings are intended to describe and provide for a finished piece of work. They are intended to be cooperative, and what is called for in either shall be as binding as if called for in both. The Contractor will understand that the work herein described shall be completed in every detail, not withstanding every item necessarily involved not particularly mentioned., and the Contractor will be held to providing the labor and material necessary for the entire completion of the work, and shall not avail himself of and manifestly unintentional error or omission, should same exist. Should any error or inconsistency appear or occur in drawings or specifications, the Contractor, before proceeding with the work, shall make mention of the same to the Architect or Engineer for proper adjustment, and in no case shall the Contractor proceed with the work in uncertainty.

#### COMPLIANCE AND GUARANTEE

Neither the final payment nor any provisions in the contract documents shall relieve the Contractor of responsibility for faulty materials or workmanship. He shall remedy any defect due thereto and pay for any damages to any work resulting there from which shall appear within a period of <u>12</u> months from the date of final payment on this contract. The Owner shall give notice of any observed defects with reasonable promptness.

PROMPTNESS OF EXECUTION

**GENERAL CONDITIONS** 

It is not incumbent upon the Architect or Engineers to notify the Contractor when to begin, cease or resume work, or to give early notice of rejection of faulty work, nor in any way superintend in such a manner as to relieve the Contractor of responsibility, or any consequence of neglect or carelessness by him or his employees or subordinates. All material and labor shall be furnished at such times as shall be for the best interest of all contractors concerned to end that the combined work of all may be properly and fully completed on contract times.

#### 1B1 SAMPLES AND SHOP DRAWINGS

Shop drawings of all fabricated work shall be submitted to the Architect for approval and no work shall be fabricated by the Contractor, save at his own risk, until approval been given. The Contractor shall be advised as to the exact procedure to be followed with respect to the number of prints required, where submitted, letters of transmittal, making corrections, etc. No less than five (5) prints of finally approved shop drawings will be required.

All shop drawings for all Contracts shall be submitted to the Architect for approval within 45 calendar days after signing of the Contracts.

The Contractor shall submit all shop drawings on dates sufficiently in advance of requirements to afford the Architect ample time for checking the same, including time for correcting, resubmission, and re-check, if necessary, and no claim for extension of the contract time will be granted the contractor by reason of his failure in this respect.

All shop drawings submitted must bear the stamp of approval of the Contractor as evidence that the drawings have been checked by the Contractor for Quantity, <u>dimensions</u>, and suitability to job conditions. Any drawings submitted without the stamp of approval will not be considered and will be returned to the Contractor for proper resubmission. No extension of time will be allowed for delay in checking shop drawings shop drawings because of the Contractor's failure to check the shop drawings before submitting them to the Architect. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reason, the Contractor shall make specific mention of such variation in his letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment; otherwise the Contract even though such shop drawings have been approved.

The Architect will process all shop drawings with as much speed as possible and in no case will have them in his office more than seven days from the time they arrive until the time they are mailed.

The review of the shop drawings will be general and shall not relieve the Contractor from the responsibility for adherence to the Contract, nor shall it relieve him of the responsibility of any error which may exist.

#### REQUESTS FOR SUPPLEMENTARY INFORMATION

It shall be the responsibility of the Contractor to make timely requests of the Architect for such large scale and full size drawings, color schemes, and other additional information, not already in his possession, which he will require in the planning and production of the work. Such requests may be submitted from time to time as the need is approached, but each such request shall be files in ample

time to permit the appropriate action to be taken by all parties involved so as to avoid delay. Each request shall be in writing and shall list the various items and the latest date by which each will be required by the Contractor.

The first list shall be submitted within two weeks after Contract award and shall be as complete as possible at that time. The Contractor shall, if requested, furnish promptly any assistance and information which the Architect may require in responding to the requests of the Contractor. The Contractor shall be fully responsible for any delay in his work or to others arising from his failure to comply fully with the provisions of this section.

### GENERAL RESPONSIBILITIES OF THE CONTRACTOR

Except as otherwise specifically stated in the Contract, the Contractor shall provide and pay for all materials, labor, tools, equipment, transportation, superintendence, temporary construction of every nature, taxes legally collectible because of the work, and all other services and facilities of every nature whatsoever necessary to execute the work to be done under the Contract and deliver it complete in every respect within the specified time.

#### OTHER CONTRACTS

The Owner may award other contracts for additional work, and the Contractor shall fully cooperate with such other contractors to carefully fit his own work to that provided under other contracts as may be directed by the Owner. The Contractor shall not commit or permit any act which will interfere with the performance or work by any other contractor.

#### FITTING AND COORDINATION OF THE WORK

The Contractor shall be responsible for the proper fitting of all work and for the coordination of the operations of all trades, subcontractors, or materialmen employed by him engaged upon the work. He shall be prepared to guarantee to each of his subcontractors the dimensions which they may require for the fitting of their work to all surrounding work and shall do, or cause his agents to do, all cutting, fitting, adjusting, and patching necessary to make the several parts of the work come together properly and to fit the work to receive, or be received by, that of other contractors.

# REMOVAL OF DEBRIS, CLEANING, ETC.

The General Contractor shall periodically, or as directed during the progress of the work, remove and properly dispose of the resultant dirt and debris, and keep the premises reasonably clear. Upon completion of the work, he shall remove all temporary construction, facilities, and unused materials provided for the work, and put buildings and premises in a neat and clean condition, and do all cleaning and washing required by the specifications. Trash burning on the site will be subject to prior approval of existing local and state agencies and regulations.

END OF DIVISION 1

**GENERAL CONDITIONS** 

# SECTION 01010 - SUMMARY OF WORK

# PART 1) - GENERAL

# a) RELATED DOCUMENTS

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

#### 1.2 PROJECT DESCRIPTION

- A. The Project consists of GENERAL CONSTRUCTION for the new NORTH STAR FAMILY DENTISTRY to be constructed on Highway 135, Mayodan, NC as shown on Contract Documents prepared by Paul Briggs, Architect.
- B. This contract consists of the following general description:
  - 1. The work consists of removing site features, rough and finish grading, storm water management, erosion control, curb, gutter and paving.
  - 2. General Construction including Plumbing, HVAC and Electrical work. Cabinet work is limited to details shown.
  - 3. Sidewalks will be by the General Contractor.
  - 4. Retaining walls, grassing for finish lawns and landscaping shall be provided by the Owner.
- C. Clearing and Grubbing is a part of this Contract.
  - 1. Stripping and stockpiling top soil is in this Contract.
  - 2. Stockpile surplus usable fill in area(s) as directed.

#### 1.3 CONTRACTOR USE OF PREMISES

- 3. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project.
- 4. This project occurs prior to the General Construction of the building. Grading Contractor shall leave the site prepared and ready for final layout by the General Contractor. Building corners shall be established and properly marked under this contract.

PART B. - PRODUCTS (Not applicable).

PART C. - EXECUTION (Not applicable).

END OF SECTION 01010

SUMMARY OF WORK

# SECTION 01020 - ALLOWANCES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing handling and processing allowances.
  - 1. Selected materials and equipment, and in some cases, their installation are shown and specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. Additional requirements, if necessary, will be issued by Change Order.
- B. Types of allowances required include the following:
  - 1. Lump sum allowances.
  - 2. Unit-cost allowances.
- C. Procedures for submitting and handling Change Orders are included in Section "Change Order Procedures."

#### 1.3 SELECTION AND PURCHASE

- A. At the earliest feasible date after Contract award, advise the Architect of the date when the final selection and purchase of each product or system described by an allowance must be completed in order to avoid delay in performance of the Work.
  - 1. When requested by the Architect, obtain proposals for each allowance for use in making final selections; include recommendations that are relevant to performance of the Work.
  - 2. Purchase products and systems as selected by the Architect from the designated supplier.

#### 1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the

# ALLOWANCES

form specified for Change Orders.

B. Submit invoices or delivery slips to indicate actual quantities of materials delivered to the site for use in fulfillment of each allowance.

PART 2 - PRODUCTS (Not Applicable)

# PART 3 - EXECUTION

# 3.1 INSPECTION

A. Inspect products covered by an allowance promptly upon delivery for damage or defects.

#### 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 construction activities.
- B. Allowance shall be for purchase of items indicated. Labor, profit, overhead, shipping, handling, taxes, etc. shall be included in the bid and will <u>not</u> be considered as part of the allowance amount.

# 3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Include a lump sum of \$7,000 for the purchase of finish hardware as defined in Section 8 of these specifications.

B. Allowance No. 2: Include accost of \$ 25.00 per sy for the purchase of carpet. This allowance is for material only. Installation, shipping, adhesives, accessories, etc are to be included in the base bid.

END OF SECTION 01020

ALLOWANCES

# SECTION 01026 - UNIT PRICES

# PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

# 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for unit prices.
  - 1. A unit price is an amount proposed by Bidders and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased.
  - 2. Unit prices include all necessary material, overhead, profit and applicable taxes.
  - 3. Refer to individual Specification Sections for construction activities requiring the establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- B. Schedule: A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods described under each unit price.
  - 1. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this Work measured by an independent surveyor acceptable to the Contractor at the Owner's expense.
- PART 2 PRODUCTS (Not Applicable).

#### PART 3 - EXECUTION

#### 3.1 UNIT PRICE SCHEDULE

- A. Item No. 1 Rock Excavation:
  - 1. Description: Rock excavation in accordance with Section "Earthwork."
  - 2. Unit of Measurement: Cubic yard of rock excavated.

#### END OF SECTION 01026

# SECTION 01027 - APPLICATIONS FOR PAYMENT

# PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing each prime Contractor's Applications for Payment.
  - 1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, List of Subcontracts, and Submittal Schedule.
- B. The Contractor's Construction Schedule and Submittal Schedule are included in Section "Submittals".

### 1.3 SCHEDULE OF VALUES

- A. Each prime Contractor shall coordinate preparation of its Schedule of Values for its part of the Work with preparation of the Contractors' Construction Schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
    - a. Contractor's construction schedule.
    - b. Application for Payment form.
    - c. List of subcontractors.
    - d. List of products.
    - e. List of principal suppliers and fabricators.
    - f. Schedule of submittals.
  - 2. Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than 14 days before the date scheduled for submittal of the initial Application for Payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
  - 1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of the Architect.
    - c. Project number.

- d. Contractor's name and address.
- e. Date of submittal.
- 2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
  - a. Generic name.
  - b. Related Specification Section.
  - c. Name of subcontractor.
  - d. Name of manufacturer or fabricator.
  - e. Name of supplier.
  - f. Change Orders (numbers) that have affected value.
  - g. Dollar value.
  - h. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.
- 3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
- 4. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
- 5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 6. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
  - a. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in- place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.
- 7. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

# 1.4 APPLICATIONS FOR PAYMENT:

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
  - 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

- B. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction Work covered by each Application or Payment is the period indicated in the Agreement.
- C. Payment Application Times: The date for each progress payment is the 15th day of each month. The period of construction Work covered by each Application for Payment is the period ending 15 days prior to the date for each progress payment and starting the day following the end of the preceding period.
- D. Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment. Other forms must be in this format and approved by the Architect, however the face sheet of AIA document must be used.
- E. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
  - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
  - 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- F. Transmittal: Submit 3 executed copies of each Application for Payment to the Architect by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.
  - 1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.
- G. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics lien from every entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, and related to the Work covered by the payment.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
  - 1. List of subcontractors.
  - 2. List of principal suppliers and fabricators.
  - 3. Schedule of Values.
  - 4. Contractor's Construction Schedule (preliminary if not final).
  - 5. Schedule of principal products.
  - 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 governing authorities for performance of the Work.
  - 12. Initial progress report.
  - 13. Report of pre-construction meeting.
  - 14. Certificates of insurance and insurance policies.

- I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Administrative actions and submittals that shall proceed or coincide with this application include:
  - 1. Warranties (guarantees) and maintenance agreements.
  - 2. Maintenance instructions.
  - 3. Change-over information related to Owner's occupancy, use, operation and maintenance.
  - 4. Final cleaning.
  - 5. Application for reduction of retainage, and consent of surety.
  - 6. Advice on shifting insurance coverages.
  - 7. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
- K. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
  - 1. Completion of Project closeout requirements.
  - 2. Completion of items specified for completion after Substantial Completion.
  - 3. Assurance that unsettled claims will be settled.
  - 4. Assurance that Work not complete and accepted will be completed without undue delay.
  - 5. Transmittal of required Project construction records to Owner.
  - 6. Proof that taxes, fees and similar obligations have been paid.
  - 7. Removal of temporary facilities and services.
  - 8. Removal of surplus materials, rubbish and similar elements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01027

# SECTION 01035 - MODIFICATION PROCEDURES

# PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to this section.

#### 1.2 SUMMARY

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
  - 2. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
  - 3. Division 1 Section "Application for Payment" for administrative procedures governing applications for payment.
  - 4. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.
- 1.3 MINOR CHANGES IN THE WORK
  - A. Supplemental instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Architect on AIA form G710, Architect's Supplemental Instructions or other suitable form determined by the Architect.

#### 1.4 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
  - 1. Proposal requests issued by the Architect are for information only. Do not consider them instructions either to stop work in progress, or to execute the proposed change.
  - 2. Unless otherwise indicated in the proposal request, within 20 days of receipt of the proposal request, submit to the Architect for the Owner's review an estimate of cost necessary to execute the proposed change.
    - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts

of trade discounts.

- c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
- B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
  - 1. Include a statement outlining the 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 Contract Time.
  - 2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
  - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - 4. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.
- C. Proposal Request Form: Use AIA Document G 709 for Change Order Proposal Requests.
- 1.5 CONSTRUCTION CHANGE DIRECTIVE
  - A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
    - 1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or 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 the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

#### 1.6 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner and Contractor on AIA Form G701, as provided in the Conditions of the Contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable) END OF SECTION 01250

MODIFICATION PROCEDURES

# SECTION 01040 - PROJECT COORDINATION

# PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
  - 1. Coordination.
  - 2. Administrative and supervisory personnel.
  - 3. General installation provisions.
  - 4. Cleaning and protection.
- B. Field engineering is included in Section "Field Engineering".
- C. Progress meetings, coordination meetings and pre-installation conferences are included in Section "Project Meetings".
- D. Requirements for the Contractor's Construction Schedule are included in Section "Submittals".

#### 1.3 COORDINATION

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
  - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
  - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.

- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
  - 1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of schedules.
  - 2. Installation and removal of temporary facilities.
  - 3. Delivery and processing of submittals.
  - 4. Progress meetings.
  - 5. Project Close-out activities.

#### 1.4 SUBMITTALS

- A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
  - 1. Show the interrelationship of components shown on separate Shop Drawings.
  - 2. Indicate required installation sequences.
  - 3. Comply with requirements contained in Section "Submittals."
  - 4. Refer to Division-15 Section "Basic Mechanical Requirements," and Division-16 Section "Basic Electrical Requirements" for specific coordination Drawing requirements for mechanical and electrical installations.
- B. Staff Names: Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
  - 1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS (Not Applicable).

# PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- 1. <u>Mounting Heights: Where mounting heights are not indicated, install individual</u> <u>components at standard mounting heights recognized within the industry for</u> <u>the particular application indicated. Refer questionable mounting height</u> <u>decisions to the Architect for final decision.</u>

#### 3.2 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

- C. Limiting Exposures: Supervise construction activities 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. Where applicable, such exposures include, but are not limited to, the following:
  - 1. Excessive static or dynamic loading.
  - 2. Excessive internal or external pressures.
  - 3. Excessively high or low temperatures.
  - 4. Thermal shock.
  - 5. Excessively high or low humidity.
  - 6. Air contamination or pollution.
  - 7. Water or ice.
  - 8. Solvents.
  - 9. Chemicals.
  - 10. Light.
  - 11. Radiation.
  - 12. Puncture.
  - 13. Abrasion.
  - 14. Heavy traffic.
  - 15. Soiling, staining and corrosion.
  - 16. Bacteria.
  - 17. Rodent and insect infestation.
  - 18. Combustion.
  - 19. Electrical current.
  - 20. High speed operation,
  - 21. Improper lubrication,
  - 22. Unusual wear or other misuse.
  - 23. Contact between incompatible materials.

- 24. Destructive testing.
- 25. Misalignment.
- 26. Excessive weathering.
- 27. Unprotected storage.
- 28. Improper shipping or handling.
- 29. Theft.
- 30. Vandalism.

# END OF SECTION 01040

# SECTION 01045 - CUTTING AND PATCHING

# PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
  - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division-15 and Division-16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

# 1.3 SUBMITTALS

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
  - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
  - 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
  - 3. List products to be used and firms or entities that will perform Work.
  - 4. Indicate dates when cutting and patching is to be performed.
  - 5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
  - 6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
  - 7. Approval by the Architect to proceed with cutting and patching does not waive the

Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

# 1.4 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.
  - 1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
    - a. Processed concrete finishes.
    - b. Preformed metal panels.
    - c. Window wall system.
    - d. Stucco and ornamental plaster.
    - e. Acoustical ceilings.
    - f. Carpeting.
    - g. Wall covering.
    - h. HVAC enclosures, cabinets or covers.

#### PART 2 - PRODUCTS

#### 2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

#### PART 3 - EXECUTION

#### 3.1 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

#### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

#### 3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
  - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
  - 1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
  - 4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
  - 5. By-pass utility services such as pipe or conduit, before cutting, where services

are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
  - 1. 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.
  - 2. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
    - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.
  - 3. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

# 3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 01045

# SECTION 01050 - FIELD ENGINEERING

# PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for field engineering services, including, but not necessarily limited to, the following:
  - 1. Land survey Work.
  - 2. Civil engineering services.
- 1.3 SUBMITTALS
  - A. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of Sections "Submittals" and "Project Closeout".
- 1.4 QUALITY ASSURANCE
  - A. Surveyor: Engage a Registered Land Surveyor or Professional Engineer to perform land surveying and layout services required.
- PART 2 PRODUCTS (Not Applicable)
- PART 3 EXECUTION
- 3.1 EXAMINATION
  - A. The Owner will identify existing control points and property line corner stakes.
  - B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
    - 1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.
    - 2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.
  - C. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.
    - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

- D. Existing utilities and equipment: 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 and other construction.
  - 1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.

#### 3.2 PERFORMANCE

- A. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each level of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. <u>Do not scale Drawings to determine dimensions.</u>
  - 1. Advise entities engaged in construction activities, of marked lines and levels provided for their use.
  - 2. As construction proceeds, check every major element for line, level and plumb.
- B. Surveyor's Log: Maintain a surveyor's log of control and other survey Work. Make this log available for reference.
  - 1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
- C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.
- D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.
- E. Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with local authorities having jurisdiction.

END OF SECTION 01410

# SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
  - 1. Pre-Construction Conference.
  - 2. Pre-Installation Conferences.
  - 3. Coordination Meetings.
  - 4. Progress Meetings.
- B. Construction schedules are specified in another Division-1 Section.

#### 1.3 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 15 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: The Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
  - 1. Tentative construction schedule.
  - 2. Critical Work sequencing.
  - 3. Designation of responsible personnel.
  - 4. Procedures for processing field decisions and Change Orders.

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- 5. Procedures for processing Applications for Payment.
- 6. Distribution of Contract Documents.
- 7. Submittal of Shop Drawings, Product Data and Samples.
- 8. Preparation of record documents.
- 9. Use of the premises.
- 10. Office, Work and storage areas.
- 11. Equipment deliveries and priorities.
- 12. Safety procedures.
- 13. First aid.
- 14. Security.
- 15. Housekeeping.
- 16. Working hours.
- D. Reporting: General Contractor is responsible for recording minutes of the meeting and distributing to all parties within 3 days of meeting.

#### 1.4 PRE-INSTALLATION CONFERENCES

- A. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The 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 the Architect of scheduled meeting dates.
  - 1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
    - a. Contract Documents.
    - b. Options.
    - c. Related Change Orders.
    - d. Purchases
    - e. Deliveries.
    - f. Shop Drawings, Product Data and quality control Samples.
    - g. Possible conflicts.
    - h. Compatibility problems.
    - i. Time schedules.
    - j. Weather limitations.
    - k. Manufacturer's recommendations.

- I. Compatibility of materials.
- m. Acceptability of substrates.
- n. Temporary facilities.
- o. Space and access limitations.
- p. Governing regulations.
- q. Safety.
- r. Inspection and testing requirements.
- s. Required performance results.
- t. Recording requirements.
- u. Protection.
- 2. General Contractor to record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner and Architect.
- 3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

### 1.5 COORDINATION MEETINGS

- A. Conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
- C. General Contractor to record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

#### 1.6 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site at regularly scheduled intervals. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.
- B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

- 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind 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.
- 2. Review the present and future needs of each entity present, including such items as:
  - a. Interface requirements.
  - b. Time.
  - c. Sequences.
  - d. Deliveries.
  - e. Off-site fabrication problems.
  - f. Access.
  - g. Site utilization.
  - h. Temporary facilities and services.
  - i. Hours of Work.
  - j. Hazards and risks.
  - k. Housekeeping.
  - I. Quality and Work standards.
  - m. Change Orders.
  - n. Documentation of information for payment requests.
- D. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report. Recording to be by General Contractor.
  - 1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01200
# SECTION 01270 - UNIT PRICES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for unit prices.
  - 1. A unit price is an amount proposed by Bidders and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased.
  - 2. Unit prices include all necessary material, overhead, profit and applicable taxes.
  - 3. Refer to individual Specification Sections for construction activities requiring the establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- B. Schedule: A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods described under each unit price.
  - 1. The Owner's surveyor will provide measurements for unit cost work,
- PART 2 PRODUCTS (Not Applicable).

#### PART 3 - EXECUTION

#### 3.1 UNIT PRICE SCHEDULE

- A. Item No. 1 Rock Excavation:
  - 1. Description: Rock excavation in accordance with Section "Earthwork."
    - a. Rock Below Grade in Open Excavations
    - b. Rock Below Grade in Trenches
  - 2. Unsuitable Soil
  - 3. Unit of Measurement: Cubic yard of rock excavated.

#### END OF SECTION 01270

# SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

# 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including;
  - 1. Contractor's construction schedule.
  - 2. Submittal schedule.
  - 3. Daily construction reports.
  - 4. Shop Drawings.
  - 5. Product Data.
  - 6. Samples.
- B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
  - 1. Permits.
  - 2. Applications for payment.
  - 3. Performance and payment bonds.
  - 4. Insurance certificates.
  - 5. List of Subcontractors.
- C. The Schedule of Values submittal is included in Section "Applications for Payment."
- D. Inspection and test reports are included in Section "Quality Control Services."

#### 1.3 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of

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performance of related construction activities to avoid delay.

- 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
- 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
  - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- 3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
  - a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Architect will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
  - b. If an intermediate submittal is necessary, process the same as the initial submittal.
  - c. Allow two weeks for reprocessing each submittal.
  - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
  - 1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
  - 2. Include the following information on the label for processing and recording action taken.
    - a. Project name.
    - b. Date.
    - c. Name and address of Owner.
    - d. Name and address of Contractor.
    - e. Name and address of subcontractor.
    - f. Name and address of supplier.
    - g. Name of manufacturer.
    - h. Number and title of appropriate Specification Section.
    - i. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and

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handling. Transmit each submittal from Contractor to Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.

1. On the transmittal Record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

### 1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar- chart type Contractor's construction schedule. Submit within 30 days of the date established for "Commencement of the Work".
  - 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
  - 2. Within each time bar indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
  - 3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
  - 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
  - 5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
  - 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
- B. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.
- C. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating "precalculated" and "actual" costs. On the line show dollar-volume of Work performed as of the dates used for preparation of payment requests.
  - 1. Refer to Section "Applications for Payment" for cost reporting and payment procedures.

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- D. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
  - 1. When revisions are made, distribute 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 construction activities.
- E. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

#### 1.5 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for establishment of the Contractor's construction schedule.
  - 1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
  - 2. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
    - a. Scheduled date for the first submittal.
    - b. Related Section number.
    - c. Submittal category.
    - d. Name of subcontractor.
    - e. Description of the part of the Work covered.
    - f. Scheduled date for resubmittal
    - g. Scheduled date the Architect's final release or approval.
- B. Distribution: Following response to initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
  - 1. When revisions are made, distribute 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 construction activities.
- C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

## 1.6 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Architect at weekly intervals:

#### SUBMITTALS

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- 1. List of subcontractors at the site.
- 2. Approximate count of personnel at the site.
- 3. High and low temperatures, general weather conditions.
- 4. Accidents and unusual events.
- 5. Meetings and significant decisions.
- 6. Stoppages, delays, shortages, losses.
- 7. Meter readings and similar recordings.
- 8. Emergency procedures.
- 9. Orders and requests of governing authorities.
- 10. Change Orders received, implemented.
- 11. Services connected, disconnected.
- 12. Equipment or system tests and start-ups.
- 13. Partial Completions, occupancies.
- 14. Substantial Completions authorized.

#### 1.7 SHOP DRAWINGS

- A. <u>Submit newly prepared information, drawn to accurate scale. Highlight,</u> <u>encircle, or otherwise indicate deviations from the Contract Documents. Do</u> <u>not reproduce Contract Documents or copy standard information as the basis of</u> <u>Shop Drawings. Standard information prepared without specific reference to</u> <u>the Project is not considered Shop Drawings.</u>
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
  - 1. Dimensions.
  - 2. Identification of products and materials included.
  - 3. Compliance with specified standards.
  - 4. Notation of coordination requirements.
  - 5. Notation of dimensions established by field measurement.
  - 6. Sheet Size: Except for templates, patterns and similar full- size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 24" x 36".
  - 7. Initial Submittal: Submit one correctable translucent reproducible print and one blue- or black-line print for the Owner's review; the reproducible print will be returned.
  - 8. Final Submittal: Submit 4 blue- or black-line prints; submit 7 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
    - a. One of the prints returned shall be marked-up and maintained as a "Record Document".
  - 9. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.
- C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.

- 1. Preparation of coordination Drawings is specified in section "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
- Submit coordination Drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.

# 1.8 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
  - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
    - a. Manufacturer's printed recommendations.
    - b. Compliance with recognized trade association standards.
    - c. Compliance with recognized testing agency standards.
    - d. Application of testing agency labels and seals.
    - e. Notation of dimensions verified by field measurement.
    - f. Notation of coordination requirements.
  - 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
  - 3. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.
  - 4. Submittals: Submit 2 copies of each required submittal; submit 4 copies where required for maintenance manuals. The Architect will retain one, and will return the other marked with action taken and corrections or modifications required.
    - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
  - 5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
    - a. Do not proceed with installation until an applicable copy of Product Data applicable is in the installer's possession.

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b. Do not permit use of unmarked copies of Product Data in connection with construction.

### 1.9 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
  - 1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect's Sample. Include the following:
    - a. Generic description of the Sample.
    - b. Sample source.
    - c. Product name or name of manufacturer.
    - d. Compliance with recognized standards.
    - e. Availability and delivery time.
  - 2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
    - a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
    - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
  - 3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
    - a. Preliminary submittals will be reviewed and returned with the Architect's mark indicating selection and other action.
  - 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.
  - 5. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
    - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

- b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
  - 1. Field Samples specified in individual Sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.
    - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

### 1.100WNER'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
  - 1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
  - 1. Final Unrestricted Release: Where submittals are marked "No Exceptions Taken," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
  - 2. Final-But-Restricted Release: When submittals are marked "Make Corrections Noted," that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
  - 3. Returned for Resubmittal: When submittal is marked "Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
    - a. Do not permit submittals marked "Revise and Resubmit" to be used at the Project site, or elsewhere where Work is in progress.
  - 4. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Action Not Required".

PART 2 - PRODUCTS (Not Applicable).

# PART 3 - EXECUTION (Not Applicable).

END OF SECTION 01300

### SECTION 01400 - QUALITY CONTROL SERVICES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services.
- B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
- D. Measurement of rock by Owner's surveyor.

#### 1.3 RESPONSIBILITIES

- A. Owner Responsibilities: The Owner shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Contractor's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Owner.
  - 1. The Owner will employ and pay an independent agency, to perform specified quality control services.
  - 2. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
    - a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
  - Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
    - a. Providing access to the Work and furnishing incidental labor and facilities

necessary to facilitate inspections and tests.

- b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
- c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
- d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
- e. Security and protection of samples and test equipment at the Project site.
- B. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
  - 1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
  - 3. The agency shall not perform any duties of the Contractor.
- C. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
  - 1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

#### 1.4 SUBMITTALS

- A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.
  - 1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
  - 2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
    - a. Date of issue.
    - b. Project title and number.
    - c. Name, address and telephone number of testing agency.
    - d. Dates and locations of samples and tests or inspections.
    - e. Names of individuals making the inspection or test.
    - f. Designation of the Work and test method.
    - g. Identification of product and Specification Section.
    - h. Complete inspection or test data.

- i. Test results and an interpretations of test results.
- j. Ambient conditions at the time of sample-taking and testing.
- k. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
- I. Name and signature of laboratory inspector.
- m. Recommendations on retesting.

### 1.5 QUALITY ASSURANCE

- A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
  - 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.
- PART 2 PRODUCTS (Not Applicable).

# PART 3 - EXECUTION

- 3.1 REPAIR AND PROTECTION
  - A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
  - B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
  - C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01400

# SECTION 01500 - TEMPORARY FACILITIES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

# 1.2 SUMMARY

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
- B. Temporary utilities required include but are not limited to:
  - 1. Water service and distribution.
  - 2. Temporary electric power and light.
  - 3. Telephone service.
- C. Temporary construction and support facilities required include but are not limited to:
  - 1. Temporary heat.
  - 2. Field offices and storage sheds.
  - 3. Temporary roads and paving.
  - 4. Sanitary facilities, including drinking water.
  - 5. Dewatering facilities and drains.
  - 6. Temporary enclosures.
  - 7. Hoists.
  - 8. Temporary Project identification signs and bulletin boards.
  - 9. Waste disposal services.
  - 10. Rodent and pest control.
  - 11. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities required include but are not limited to:
  - 1. Temporary fire protection.

- 2. Barricades, warning signs, lights.
- 3. Environmental protection.
- E. Assignment of temporary facility responsibility:

1. GC to provide temporary heat, lights, telephone, and sanitary facilities. He is also responsible for paying the utility bill.

2. Electrical Contractor to provide temporary electrical power service at the start of construction.

3. Plumbing Contractor to provide water service to the building at the start of construction.

- 1.3 SUBMITTALS
  - A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.
  - B. Implementation and Termination Schedule: Submit a schedule indicating implementation and termination of each temporary utility within 15 days of the date established for commencement of the Work.

#### 1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
  - 1. Building Code requirements.
  - 2. Health and safety regulations.
  - 3. Utility company regulations.
  - 4. Police, Fire Department and Rescue Squad rules.
  - 5. Environmental protection regulations.
- B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."
  - 1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.
  - 2. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

### 1.5 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

#### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General: Provide new materials; if acceptable to the Owner, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Lumber and Plywood: Comply with requirements in Division-6 Section "Rough Carpentry."
  - 1. For job-built temporary offices, shops and sheds within the construction area, provide UL labeled, fire treated lumber and plywood for framing, sheathing and siding.
  - 2. For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thickness indicated.
  - 3. For fences and vision barriers, provide exterior type, minimum 3/8" thick plywood.
  - 4. For safety barriers, sidewalk bridges and similar uses, provide minimum 5/8" thick exterior plywood.
- C. Paint: Comply with requirements of Division-9 Section "Finish Painting."
  - 1. For job-built temporary offices, shops, sheds, fences and other exposed lumber and plywood, provide exterior grade acrylic-latex emulsion over exterior primer.
  - 2. For sign panels and applying graphics, provide exterior grade alkyd gloss enamel over exterior primer.
  - 3. For interior walls of temporary offices, provide two coats interior latex flat wall paint.

- D. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- E. Water: Provide potable water approved by local health authorities.
- F. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel pipe posts, 1-1/2" I.D. for line posts and 2-1/2" I.D. for corner posts.

# 2.2 EQUIPMENT

- A. General: Provide new equipment; if acceptable to the Owner, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows and serviceable finishes. Provide heated and air- conditioned units on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.
- I. First Aid Supplies: Comply with governing regulations.
- J. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide

hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

# PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
  - 1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
  - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
  - 3. Obtain easements to bring temporary utilities to the site, where the Owner's easements cannot be used for that purpose.
  - 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner, and will not be accepted as a basis of claims for a Change Order.
- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
  - 1. Sterilization: Sterilize temporary water piping prior to use.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.
  - 1. Except where overhead service must be used, install electric power service underground.
  - 2. Power Distribution System: Install wiring overhead, and rise vertically where

least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

- D. Temporary Lighting: Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.
  - 1. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period. Install telephone on a separate line for each temporary office and first aid station. Where an office has more than two occupants, install a telephone for each additional occupant or pair of occupants.
  - 1. At each telephone, post a list of important telephone numbers.
- F. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off the site in a lawful manner.
  - 1. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.
  - 2. Connect temporary sewers to the municipal system as directed by the sewer department officials.
  - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
- G. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

# 3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
  - 1. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from

adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

- C. Heating Facilities: Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
- D. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:
- E. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on the site.
- F. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
  - 1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
- G. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
- H. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper supply.
- I. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division-2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations and construction free of water.
- J. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
  - 1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

- 2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
- 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.
- K. Project Identification and Temporary Signs: Prepare project identification and other signs of the size indicated; install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood or steel. Do not permit installation of unauthorized signs.
  - 1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
  - 2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- L. Temporary Exterior Lighting: Install exterior yard and sign lights so that signs are visible when Work is being performed.
- M. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.
- N. Rodent and Pest Control: Before deep foundation Work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be relatively free of pests and their residues at Substantial Completion. Perform control operations in a lawful manner using environmentally safe materials.

# 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Owner.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
  - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.

- 2. Store combustible materials in containers in fire-safe locations.
- 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
- 4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
- E. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.
  - 1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- F. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

# 3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.
  - 2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

- C. Termination and Removal: Unless the Owner requests that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the 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 the Contractor. The Owner reserves the right to take possession of Project identification signs.
  - 2. Remove temporary paving that is not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances which might impair growth of plant materials or lawns. Repair or replace street paving, curbs and sidewalks at the temporary entrances, as required by the governing authority.
  - 3. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
    - a. Replace air filters and clean inside of ductwork and housings.
    - b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
    - c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

END OF SECTION 01500

### SECTION 01600 - MATERIALS AND EQUIPMENT

# PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section "Submittals."
- C. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.
- D. Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section "Product Substitutions."

#### 1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms such are self-explanatory and have well recognized meanings in the construction industry.
  - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
    - a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
    - b. "Foreign Products", as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside of the United States and its possessions; or produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of nor living within the United States and its possessions.
  - 2. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

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3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

### 1.4 SUBMITTALS

- A. Product List Schedule: Prepare a schedule showing products specified in a tabular form acceptable to the Owner. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.
  - 1. Coordinate the product list schedule with the Contractor's Construction Schedule and the Schedule of Submittals.
  - 2. Form: Prepare the product listing schedule with information on each item tabulated under the following column headings:
    - a. Related Specification Section number.
    - b. Generic name used in Contract Documents.
    - c. Proprietary name, model number and similar designations.
    - d. Manufacturer's and name and address.
    - e. Supplier's name and address.
    - f. Installer's name and address.
    - g. Projected delivery date, or time span of delivery period.
  - 3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.
    - a. At the Contractor's option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.
  - 4. Completed Schedule: Within 60 days after date of commencement of the Work, submit 3 copies of the completed product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.
  - 5. Owner's Action: The Owner will respond in writing to the Contractor within 2 weeks of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or products, but does not constitute a waiver of the requirement that products comply with Contract Documents. The Owner's response will include the following:
    - a. A list of unacceptable product selections, containing a brief explanation of reasons for this action.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
  - 1. When specified products are available only from sources that do not or cannot produce a quantity adequate to complete project requirements in a timely

manner, consult with the Owner for a determination of the most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources that produce products that possess these qualities, to the fullest extent possible.

- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
  - 1. Single prime Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of separate Contractors.
  - 2. If a dispute arises over incompatible products, the Owner will determine which products shall be retained and which are incompatible and must be replaced.
- C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:
  - 1. No available domestic product complies with the Contract Documents.
- D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
  - 1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
  - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
    - a. Name of product and manufacturer.
    - b. Model and serial number.
    - c. Capacity.
    - d. Speed.
    - e. Ratings.

# 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.
  - 1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

- 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
- 3. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
- 4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
- 5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
- 6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
- 7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

# PART 2 - PRODUCTS

# 2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
  - 1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
  - 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
  - 1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
  - 2. Semiproprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.

- a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
- 3. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
- 4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
- 5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.
  - a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
- 6. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
- 7. Visual Matching: Where Specifications require matching an established Sample, the Owner's decision will be final on whether a proposed product matches satisfactorily.
  - a. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.
- 8. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Owner will select the color, pattern and texture from the product line selected.
- 9. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division-1 for allowances that control product selection, and for procedures required for processing such selections.

# PART 3 - EXECUTION

### 3.1 INSTALLATION OF PRODUCTS:

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
  - 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01600

# SECTION 01631 - PRODUCT SUBSTITUTIONS

# PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section "Submittals."
- C. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.
- D. Procedural requirements governing the Contractor's selection of products and product options are included under Section "Materials and Equipment."

#### 1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions." The following are not considered substitutions:
  - 1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
  - 2. Revisions to Contract Documents requested by the Owner.
  - 3. Specified options of products and construction methods included in Contract Documents.
  - 4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

#### 1.4 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if

received within 60 days after commencement of the Work. Requests received more than 60 days after commencement of the Work may be considered or rejected at the discretion of the Owner.

- 1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
- Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
  - a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
  - b. Samples, where applicable or requested.
  - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
  - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.
  - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
  - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
  - g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
- 3. Owner's Action: Within one week of receipt of the request for substitution, the Owner will request additional information or documentation necessary for evaluation of the request. Within 2 weeks of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Owner will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name.

Acceptance will be in the form of a Change Order.

# PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Conditions: The Contractor's substitution request will be received and considered by the Owner when one or more of the following conditions are satisfied, as determined by the Owner; otherwise requests will be returned without action except to record noncompliance with these requirements.
  - 1. Extensive revisions to Contract Documents are not required.
  - 2. Proposed changes are in keeping with the general intent of Contract Documents.
  - 3. The request is timely, fully documented and properly submitted.
  - 4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
  - 5. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
  - 6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
  - 7. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Owner for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
  - 8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
  - 9. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
  - 10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
  - 11. Where a proposed substitution involves more than one prime Contractor, each

Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.

- B. The Contractor's submittal and Owner's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.
- PART 3 EXECUTION (Not Applicable)

END OF SECTION 01631

# SECTION 01700 - PROJECT CLOSEOUT

# PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
  - 1. Inspection procedures.
  - 2. Project record document submittal.
  - 3. Operating and maintenance manual submittal.
  - 4. Submittal of warranties.
  - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions-2 through -16.

#### 1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
  - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
  - 2. Advise Owner of pending insurance change-over requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

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- 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
- 5. Deliver tools, spare parts, extra stock, and similar items.
- 6. Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.
- 7. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
- 8. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
  - 1. The Architect will repeat inspection when requested and assured that the Work has been substantially completed.
  - 2. Results of the completed inspection will form the basis of requirements for final acceptance.

# 1.4 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
  - 1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
  - 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
  - 3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
  - 4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
  - 5. Submit consent of surety to final payment.

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- 6. Submit a final liquidated damages settlement statement, if any.
- 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Architect will reinspect the Work upon receipt of written notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.
  - 1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
  - 2. If necessary, reinspection will be repeated.

# 1.5 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
  - 1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
  - 2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
  - 3. Note related Change Order numbers where applicable.
  - 4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.
- 1. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
  - 1. Upon completion of mark-up, submit complete set of record Product Data to the Architect for the Owner's records.
- E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.
- G. Maintenance Manuals: (Maintenance Manuals are required for General, Plumbing, HVAC, Electrical and Kitchen Equipment contracts.) Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information; provide 2 copies of General Construction Manuals, 3 copies of all other contracts:
  - 1. Emergency instructions.
  - 2. Spare parts list.
  - 3. Copies of warranties.
  - 4. Wiring diagrams.
  - 5. Recommended "turn around" cycles.
  - 6. Inspection procedures.
  - 7. Shop Drawings and Product Data.
  - 8. Fixture lamping schedule.
- PART 2 PRODUCTS (Not Applicable)

PART 3 - EXECUTION

PROJECT CLOSEOUT

# 3.1 CLOSEOUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of at lease the following items:
  - 1. Maintenance manuals.
  - 2. Record documents.
  - 3. Spare parts and materials.
  - 4. Tools.
  - 5. Lubricants.
  - 6. Fuels.
  - 7. Identification systems.
  - 8. Control sequences.
  - 9. Hazards.
  - 10. Cleaning.
  - 11. Warranties and bonds.
  - 12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
  - 1. Start-up.
  - 2. Shutdown.
  - 3. Emergency operations.
  - 4. Noise and vibration adjustments.
  - 5. Safety procedures.
  - 6. Economy and efficiency adjustments.
  - 7. Effective energy utilization.

#### 3.2 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
  - 1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion. Additional cleaning may be required if work required after substantial completion creates dust, dirt, etc.
    - a. Remove labels that are not permanent labels.
    - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
    - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free

condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

- d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
- e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C. Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.
- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
  - 1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

# SECTION 01740 - WARRANTIES AND BONDS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.
  - 1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.
  - 2. General closeout requirements are included in Section "Project Closeout."
  - 3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions-2 through -16.
  - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- C. Single Prime Contract: Single prime Contractor is responsible for warranties related to the Contract.

#### 1.3 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract

Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

## 1.4 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
  - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

## 1.5 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. If the Owner's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.
  - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen days of completion of that designated portion of the Work.

B. When a special warranty is required to be executed by the Contractor, or the Contractor

and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Owner for approval prior to final execution.

- 1. Refer to individual Sections of Divisions-2 through -16 for specific content requirements, and particular requirements for submittal of special warranties.
- C. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
  - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
  - 2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS, the Project title or name, and the name of the Contractor.
  - 3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
- PART 2 PRODUCTS (not applicable).

# PART 3 - EXECUTION

# 3.1 SCHEDULE OF WARRANTIES

A. Schedule: Provide warranties and bonds on products and installations as specified in the following Sections:

Termite Control Treatment:	Section 02280 - Termite Control
Wood Doors:	Section 08211 - Wood Doors
Aluminum Windows:	Section 08520 - Aluminum Windows
Insulating Glass:	Section 08800 - Glass and Glazing

Carpet:	Section 09680 - Carpet
Water Heaters:	Section 15458 - Water Heaters
Packaged Heating and Cooling Units:	Section 15781 - Packaged Heating

# SECTION 01010 - SUMMARY OF WORK

# PART 1) - GENERAL

## a) RELATED DOCUMENTS

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

### 1.2 PROJECT DESCRIPTION

- A. The Project consists of GENERAL CONSTRUCTION for the new NORTH STAR FAMILY DENTISTRY to be constructed on Highway 135, Mayodan, NC as shown on Contract Documents prepared by Paul Briggs, Architect.
- B. This contract consists of the following general description:
  - 1. The work consists of removing site features, rough and finish grading, storm water management, erosion control, curb, gutter and paving.
  - 2. General Construction including Plumbing, HVAC and Electrical work. Cabinet work is limited to details shown.
  - 3. Sidewalks will be by the General Contractor.
  - 4. Retaining walls, grassing for finish lawns and landscaping shall be provided by the Owner.
- C. Clearing and Grubbing is a part of this Contract.
  - 1. Stripping and stockpiling top soil is in this Contract.
  - 2. Stockpile surplus usable fill in area(s) as directed.

#### 1.3 CONTRACTOR USE OF PREMISES

- 3. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project.
- 4. This project occurs prior to the General Construction of the building. Grading Contractor shall leave the site prepared and ready for final layout by the General Contractor. Building corners shall be established and properly marked under this contract.

PART B. - PRODUCTS (Not applicable).

PART C. - EXECUTION (Not applicable).

END OF SECTION 01010

SUMMARY OF WORK

# SECTION 01020 - ALLOWANCES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing handling and processing allowances.
  - 1. Selected materials and equipment, and in some cases, their installation are shown and specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. Additional requirements, if necessary, will be issued by Change Order.
- B. Types of allowances required include the following:
  - 1. Lump sum allowances.
  - 2. Unit-cost allowances.
- C. Procedures for submitting and handling Change Orders are included in Section "Change Order Procedures."

#### 1.3 SELECTION AND PURCHASE

- A. At the earliest feasible date after Contract award, advise the Architect of the date when the final selection and purchase of each product or system described by an allowance must be completed in order to avoid delay in performance of the Work.
  - 1. When requested by the Architect, obtain proposals for each allowance for use in making final selections; include recommendations that are relevant to performance of the Work.
  - 2. Purchase products and systems as selected by the Architect from the designated supplier.

#### 1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the

# ALLOWANCES

form specified for Change Orders.

B. Submit invoices or delivery slips to indicate actual quantities of materials delivered to the site for use in fulfillment of each allowance.

PART 2 - PRODUCTS (Not Applicable)

# PART 3 - EXECUTION

## 3.1 INSPECTION

A. Inspect products covered by an allowance promptly upon delivery for damage or defects.

#### 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 construction activities.
- B. Allowance shall be for purchase of items indicated. Labor, profit, overhead, shipping, handling, taxes, etc. shall be included in the bid and will <u>not</u> be considered as part of the allowance amount.

## 3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Include a lump sum of \$7,000 for the purchase of finish hardware as defined in Section 8 of these specifications.

B. Allowance No. 2: Include accost of \$ 25.00 per sy for the purchase of carpet. This allowance is for material only. Installation, shipping, adhesives, accessories, etc are to be included in the base bid.

END OF SECTION 01020

ALLOWANCES

## SECTION 01026 - UNIT PRICES

# PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for unit prices.
  - 1. A unit price is an amount proposed by Bidders and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased.
  - 2. Unit prices include all necessary material, overhead, profit and applicable taxes.
  - 3. Refer to individual Specification Sections for construction activities requiring the establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- B. Schedule: A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods described under each unit price.
  - 1. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this Work measured by an independent surveyor acceptable to the Contractor at the Owner's expense.
- PART 2 PRODUCTS (Not Applicable).

#### PART 3 - EXECUTION

#### 3.1 UNIT PRICE SCHEDULE

- A. Item No. 1 Rock Excavation:
  - 1. Description: Rock excavation in accordance with Section "Earthwork."
  - 2. Unit of Measurement: Cubic yard of rock excavated.

# SECTION 01027 - APPLICATIONS FOR PAYMENT

# PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing each prime Contractor's Applications for Payment.
  - 1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, List of Subcontracts, and Submittal Schedule.
- B. The Contractor's Construction Schedule and Submittal Schedule are included in Section "Submittals".

## 1.3 SCHEDULE OF VALUES

- A. Each prime Contractor shall coordinate preparation of its Schedule of Values for its part of the Work with preparation of the Contractors' Construction Schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
    - a. Contractor's construction schedule.
    - b. Application for Payment form.
    - c. List of subcontractors.
    - d. List of products.
    - e. List of principal suppliers and fabricators.
    - f. Schedule of submittals.
  - 2. Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than 14 days before the date scheduled for submittal of the initial Application for Payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
  - 1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of the Architect.
    - c. Project number.

- d. Contractor's name and address.
- e. Date of submittal.
- 2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
  - a. Generic name.
  - b. Related Specification Section.
  - c. Name of subcontractor.
  - d. Name of manufacturer or fabricator.
  - e. Name of supplier.
  - f. Change Orders (numbers) that have affected value.
  - g. Dollar value.
  - h. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.
- 3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
- 4. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
- 5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 6. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
  - a. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in- place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.
- 7. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

# 1.4 APPLICATIONS FOR PAYMENT:

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
  - 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

- B. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction Work covered by each Application or Payment is the period indicated in the Agreement.
- C. Payment Application Times: The date for each progress payment is the 15th day of each month. The period of construction Work covered by each Application for Payment is the period ending 15 days prior to the date for each progress payment and starting the day following the end of the preceding period.
- D. Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment. Other forms must be in this format and approved by the Architect, however the face sheet of AIA document must be used.
- E. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
  - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
  - 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- F. Transmittal: Submit 3 executed copies of each Application for Payment to the Architect by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.
  - 1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.
- G. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics lien from every entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, and related to the Work covered by the payment.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
  - 1. List of subcontractors.
  - 2. List of principal suppliers and fabricators.
  - 3. Schedule of Values.
  - 4. Contractor's Construction Schedule (preliminary if not final).
  - 5. Schedule of principal products.
  - 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 governing authorities for performance of the Work.
  - 12. Initial progress report.
  - 13. Report of pre-construction meeting.
  - 14. Certificates of insurance and insurance policies.

- I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Administrative actions and submittals that shall proceed or coincide with this application include:
  - 1. Warranties (guarantees) and maintenance agreements.
  - 2. Maintenance instructions.
  - 3. Change-over information related to Owner's occupancy, use, operation and maintenance.
  - 4. Final cleaning.
  - 5. Application for reduction of retainage, and consent of surety.
  - 6. Advice on shifting insurance coverages.
  - 7. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
- K. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
  - 1. Completion of Project closeout requirements.
  - 2. Completion of items specified for completion after Substantial Completion.
  - 3. Assurance that unsettled claims will be settled.
  - 4. Assurance that Work not complete and accepted will be completed without undue delay.
  - 5. Transmittal of required Project construction records to Owner.
  - 6. Proof that taxes, fees and similar obligations have been paid.
  - 7. Removal of temporary facilities and services.
  - 8. Removal of surplus materials, rubbish and similar elements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

# SECTION 01035 - MODIFICATION PROCEDURES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to this section.

### 1.2 SUMMARY

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
  - 2. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
  - 3. Division 1 Section "Application for Payment" for administrative procedures governing applications for payment.
  - 4. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.
- 1.3 MINOR CHANGES IN THE WORK
  - A. Supplemental instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Architect on AIA form G710, Architect's Supplemental Instructions or other suitable form determined by the Architect.

#### 1.4 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
  - 1. Proposal requests issued by the Architect are for information only. Do not consider them instructions either to stop work in progress, or to execute the proposed change.
  - 2. Unless otherwise indicated in the proposal request, within 20 days of receipt of the proposal request, submit to the Architect for the Owner's review an estimate of cost necessary to execute the proposed change.
    - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts

of trade discounts.

- c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
- B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
  - 1. Include a statement outlining the 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 Contract Time.
  - 2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
  - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - 4. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.
- C. Proposal Request Form: Use AIA Document G 709 for Change Order Proposal Requests.
- 1.5 CONSTRUCTION CHANGE DIRECTIVE
  - A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
    - 1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or 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 the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

#### 1.6 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner and Contractor on AIA Form G701, as provided in the Conditions of the Contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable) END OF SECTION 01250

MODIFICATION PROCEDURES

# SECTION 01040 - PROJECT COORDINATION

# PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
  - 1. Coordination.
  - 2. Administrative and supervisory personnel.
  - 3. General installation provisions.
  - 4. Cleaning and protection.
- B. Field engineering is included in Section "Field Engineering".
- C. Progress meetings, coordination meetings and pre-installation conferences are included in Section "Project Meetings".
- D. Requirements for the Contractor's Construction Schedule are included in Section "Submittals".

### 1.3 COORDINATION

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
  - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
  - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.

- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
  - 1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of schedules.
  - 2. Installation and removal of temporary facilities.
  - 3. Delivery and processing of submittals.
  - 4. Progress meetings.
  - 5. Project Close-out activities.

#### 1.4 SUBMITTALS

- A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
  - 1. Show the interrelationship of components shown on separate Shop Drawings.
  - 2. Indicate required installation sequences.
  - 3. Comply with requirements contained in Section "Submittals."
  - 4. Refer to Division-15 Section "Basic Mechanical Requirements," and Division-16 Section "Basic Electrical Requirements" for specific coordination Drawing requirements for mechanical and electrical installations.
- B. Staff Names: Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
  - 1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS (Not Applicable).

# PART 3 - EXECUTION

## 3.1 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- 1. <u>Mounting Heights: Where mounting heights are not indicated, install individual</u> <u>components at standard mounting heights recognized within the industry for</u> <u>the particular application indicated. Refer questionable mounting height</u> <u>decisions to the Architect for final decision.</u>

## 3.2 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

- C. Limiting Exposures: Supervise construction activities 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. Where applicable, such exposures include, but are not limited to, the following:
  - 1. Excessive static or dynamic loading.
  - 2. Excessive internal or external pressures.
  - 3. Excessively high or low temperatures.
  - 4. Thermal shock.
  - 5. Excessively high or low humidity.
  - 6. Air contamination or pollution.
  - 7. Water or ice.
  - 8. Solvents.
  - 9. Chemicals.
  - 10. Light.
  - 11. Radiation.
  - 12. Puncture.
  - 13. Abrasion.
  - 14. Heavy traffic.
  - 15. Soiling, staining and corrosion.
  - 16. Bacteria.
  - 17. Rodent and insect infestation.
  - 18. Combustion.
  - 19. Electrical current.
  - 20. High speed operation,
  - 21. Improper lubrication,
  - 22. Unusual wear or other misuse.
  - 23. Contact between incompatible materials.

- 24. Destructive testing.
- 25. Misalignment.
- 26. Excessive weathering.
- 27. Unprotected storage.
- 28. Improper shipping or handling.
- 29. Theft.
- 30. Vandalism.

# SECTION 01045 - CUTTING AND PATCHING

# PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
  - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division-15 and Division-16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

# 1.3 SUBMITTALS

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
  - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
  - 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
  - 3. List products to be used and firms or entities that will perform Work.
  - 4. Indicate dates when cutting and patching is to be performed.
  - 5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
  - 6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
  - 7. Approval by the Architect to proceed with cutting and patching does not waive the

Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

# 1.4 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.
  - 1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
    - a. Processed concrete finishes.
    - b. Preformed metal panels.
    - c. Window wall system.
    - d. Stucco and ornamental plaster.
    - e. Acoustical ceilings.
    - f. Carpeting.
    - g. Wall covering.
    - h. HVAC enclosures, cabinets or covers.

#### PART 2 - PRODUCTS

#### 2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

## PART 3 - EXECUTION

## 3.1 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

#### 3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
  - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
  - 1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
  - 4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
  - 5. By-pass utility services such as pipe or conduit, before cutting, where services

are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
  - 1. 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.
  - 2. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
    - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.
  - 3. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

# 3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

# SECTION 01050 - FIELD ENGINEERING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for field engineering services, including, but not necessarily limited to, the following:
  - 1. Land survey Work.
  - 2. Civil engineering services.
- 1.3 SUBMITTALS
  - A. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of Sections "Submittals" and "Project Closeout".
- 1.4 QUALITY ASSURANCE
  - A. Surveyor: Engage a Registered Land Surveyor or Professional Engineer to perform land surveying and layout services required.
- PART 2 PRODUCTS (Not Applicable)
- PART 3 EXECUTION
- 3.1 EXAMINATION
  - A. The Owner will identify existing control points and property line corner stakes.
  - B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
    - 1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.
    - 2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.
  - C. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.
    - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

- D. Existing utilities and equipment: 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 and other construction.
  - 1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.

### 3.2 PERFORMANCE

- A. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each level of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. <u>Do not scale Drawings to determine dimensions.</u>
  - 1. Advise entities engaged in construction activities, of marked lines and levels provided for their use.
  - 2. As construction proceeds, check every major element for line, level and plumb.
- B. Surveyor's Log: Maintain a surveyor's log of control and other survey Work. Make this log available for reference.
  - 1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
- C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.
- D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.
- E. Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with local authorities having jurisdiction.

# SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
  - 1. Pre-Construction Conference.
  - 2. Pre-Installation Conferences.
  - 3. Coordination Meetings.
  - 4. Progress Meetings.
- B. Construction schedules are specified in another Division-1 Section.

#### 1.3 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 15 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: The Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
  - 1. Tentative construction schedule.
  - 2. Critical Work sequencing.
  - 3. Designation of responsible personnel.
  - 4. Procedures for processing field decisions and Change Orders.

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- 5. Procedures for processing Applications for Payment.
- 6. Distribution of Contract Documents.
- 7. Submittal of Shop Drawings, Product Data and Samples.
- 8. Preparation of record documents.
- 9. Use of the premises.
- 10. Office, Work and storage areas.
- 11. Equipment deliveries and priorities.
- 12. Safety procedures.
- 13. First aid.
- 14. Security.
- 15. Housekeeping.
- 16. Working hours.
- D. Reporting: General Contractor is responsible for recording minutes of the meeting and distributing to all parties within 3 days of meeting.

#### 1.4 PRE-INSTALLATION CONFERENCES

- A. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The 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 the Architect of scheduled meeting dates.
  - 1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
    - a. Contract Documents.
    - b. Options.
    - c. Related Change Orders.
    - d. Purchases
    - e. Deliveries.
    - f. Shop Drawings, Product Data and quality control Samples.
    - g. Possible conflicts.
    - h. Compatibility problems.
    - i. Time schedules.
    - j. Weather limitations.
    - k. Manufacturer's recommendations.

- I. Compatibility of materials.
- m. Acceptability of substrates.
- n. Temporary facilities.
- o. Space and access limitations.
- p. Governing regulations.
- q. Safety.
- r. Inspection and testing requirements.
- s. Required performance results.
- t. Recording requirements.
- u. Protection.
- 2. General Contractor to record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner and Architect.
- 3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

## 1.5 COORDINATION MEETINGS

- A. Conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
- C. General Contractor to record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

#### 1.6 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site at regularly scheduled intervals. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.
- B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

- 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind 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.
- 2. Review the present and future needs of each entity present, including such items as:
  - a. Interface requirements.
  - b. Time.
  - c. Sequences.
  - d. Deliveries.
  - e. Off-site fabrication problems.
  - f. Access.
  - g. Site utilization.
  - h. Temporary facilities and services.
  - i. Hours of Work.
  - j. Hazards and risks.
  - k. Housekeeping.
  - I. Quality and Work standards.
  - m. Change Orders.
  - n. Documentation of information for payment requests.
- D. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report. Recording to be by General Contractor.
  - 1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

# SECTION 01270 - UNIT PRICES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for unit prices.
  - 1. A unit price is an amount proposed by Bidders and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased.
  - 2. Unit prices include all necessary material, overhead, profit and applicable taxes.
  - 3. Refer to individual Specification Sections for construction activities requiring the establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- B. Schedule: A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods described under each unit price.
  - 1. The Owner's surveyor will provide measurements for unit cost work,
- PART 2 PRODUCTS (Not Applicable).

#### PART 3 - EXECUTION

#### 3.1 UNIT PRICE SCHEDULE

- A. Item No. 1 Rock Excavation:
  - 1. Description: Rock excavation in accordance with Section "Earthwork."
    - a. Rock Below Grade in Open Excavations
    - b. Rock Below Grade in Trenches
  - 2. Unsuitable Soil
  - 3. Unit of Measurement: Cubic yard of rock excavated.

# SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

# 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including;
  - 1. Contractor's construction schedule.
  - 2. Submittal schedule.
  - 3. Daily construction reports.
  - 4. Shop Drawings.
  - 5. Product Data.
  - 6. Samples.
- B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
  - 1. Permits.
  - 2. Applications for payment.
  - 3. Performance and payment bonds.
  - 4. Insurance certificates.
  - 5. List of Subcontractors.
- C. The Schedule of Values submittal is included in Section "Applications for Payment."
- D. Inspection and test reports are included in Section "Quality Control Services."

#### 1.3 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of

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performance of related construction activities to avoid delay.

- 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
- 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
  - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- 3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
  - a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Architect will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
  - b. If an intermediate submittal is necessary, process the same as the initial submittal.
  - c. Allow two weeks for reprocessing each submittal.
  - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
  - 1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
  - 2. Include the following information on the label for processing and recording action taken.
    - a. Project name.
    - b. Date.
    - c. Name and address of Owner.
    - d. Name and address of Contractor.
    - e. Name and address of subcontractor.
    - f. Name and address of supplier.
    - g. Name of manufacturer.
    - h. Number and title of appropriate Specification Section.
    - i. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and

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handling. Transmit each submittal from Contractor to Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.

1. On the transmittal Record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

## 1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar- chart type Contractor's construction schedule. Submit within 30 days of the date established for "Commencement of the Work".
  - 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
  - 2. Within each time bar indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
  - 3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
  - 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
  - 5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
  - 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
- B. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.
- C. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating "precalculated" and "actual" costs. On the line show dollar-volume of Work performed as of the dates used for preparation of payment requests.
  - 1. Refer to Section "Applications for Payment" for cost reporting and payment procedures.
- D. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
  - 1. When revisions are made, distribute 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 construction activities.
- E. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

#### 1.5 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for establishment of the Contractor's construction schedule.
  - 1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
  - 2. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
    - a. Scheduled date for the first submittal.
    - b. Related Section number.
    - c. Submittal category.
    - d. Name of subcontractor.
    - e. Description of the part of the Work covered.
    - f. Scheduled date for resubmittal
    - g. Scheduled date the Architect's final release or approval.
- B. Distribution: Following response to initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
  - 1. When revisions are made, distribute 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 construction activities.
- C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

## 1.6 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Architect at weekly intervals:

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- 1. List of subcontractors at the site.
- 2. Approximate count of personnel at the site.
- 3. High and low temperatures, general weather conditions.
- 4. Accidents and unusual events.
- 5. Meetings and significant decisions.
- 6. Stoppages, delays, shortages, losses.
- 7. Meter readings and similar recordings.
- 8. Emergency procedures.
- 9. Orders and requests of governing authorities.
- 10. Change Orders received, implemented.
- 11. Services connected, disconnected.
- 12. Equipment or system tests and start-ups.
- 13. Partial Completions, occupancies.
- 14. Substantial Completions authorized.

#### 1.7 SHOP DRAWINGS

- A. <u>Submit newly prepared information, drawn to accurate scale. Highlight,</u> <u>encircle, or otherwise indicate deviations from the Contract Documents. Do</u> <u>not reproduce Contract Documents or copy standard information as the basis of</u> <u>Shop Drawings. Standard information prepared without specific reference to</u> <u>the Project is not considered Shop Drawings.</u>
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
  - 1. Dimensions.
  - 2. Identification of products and materials included.
  - 3. Compliance with specified standards.
  - 4. Notation of coordination requirements.
  - 5. Notation of dimensions established by field measurement.
  - 6. Sheet Size: Except for templates, patterns and similar full- size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 24" x 36".
  - 7. Initial Submittal: Submit one correctable translucent reproducible print and one blue- or black-line print for the Owner's review; the reproducible print will be returned.
  - 8. Final Submittal: Submit 4 blue- or black-line prints; submit 7 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
    - a. One of the prints returned shall be marked-up and maintained as a "Record Document".
  - 9. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.
- C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.

- 1. Preparation of coordination Drawings is specified in section "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
- Submit coordination Drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.

## 1.8 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
  - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
    - a. Manufacturer's printed recommendations.
    - b. Compliance with recognized trade association standards.
    - c. Compliance with recognized testing agency standards.
    - d. Application of testing agency labels and seals.
    - e. Notation of dimensions verified by field measurement.
    - f. Notation of coordination requirements.
  - 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
  - 3. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.
  - 4. Submittals: Submit 2 copies of each required submittal; submit 4 copies where required for maintenance manuals. The Architect will retain one, and will return the other marked with action taken and corrections or modifications required.
    - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
  - 5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
    - a. Do not proceed with installation until an applicable copy of Product Data applicable is in the installer's possession.

b. Do not permit use of unmarked copies of Product Data in connection with construction.

### 1.9 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
  - 1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect's Sample. Include the following:
    - a. Generic description of the Sample.
    - b. Sample source.
    - c. Product name or name of manufacturer.
    - d. Compliance with recognized standards.
    - e. Availability and delivery time.
  - 2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
    - a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
    - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
  - 3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
    - a. Preliminary submittals will be reviewed and returned with the Architect's mark indicating selection and other action.
  - 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.
  - 5. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
    - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

- b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
  - 1. Field Samples specified in individual Sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.
    - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

## 1.100WNER'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
  - 1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
  - 1. Final Unrestricted Release: Where submittals are marked "No Exceptions Taken," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
  - 2. Final-But-Restricted Release: When submittals are marked "Make Corrections Noted," that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
  - 3. Returned for Resubmittal: When submittal is marked "Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
    - a. Do not permit submittals marked "Revise and Resubmit" to be used at the Project site, or elsewhere where Work is in progress.
  - 4. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Action Not Required".

PART 2 - PRODUCTS (Not Applicable).

# PART 3 - EXECUTION (Not Applicable).

END OF SECTION 01300

## SECTION 01400 - QUALITY CONTROL SERVICES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services.
- B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
- D. Measurement of rock by Owner's surveyor.

#### 1.3 RESPONSIBILITIES

- A. Owner Responsibilities: The Owner shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Contractor's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Owner.
  - 1. The Owner will employ and pay an independent agency, to perform specified quality control services.
  - 2. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
    - a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
  - Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
    - a. Providing access to the Work and furnishing incidental labor and facilities

necessary to facilitate inspections and tests.

- b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
- c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
- d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
- e. Security and protection of samples and test equipment at the Project site.
- B. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
  - 1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
  - 3. The agency shall not perform any duties of the Contractor.
- C. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
  - 1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

#### 1.4 SUBMITTALS

- A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.
  - 1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
  - 2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
    - a. Date of issue.
    - b. Project title and number.
    - c. Name, address and telephone number of testing agency.
    - d. Dates and locations of samples and tests or inspections.
    - e. Names of individuals making the inspection or test.
    - f. Designation of the Work and test method.
    - g. Identification of product and Specification Section.
    - h. Complete inspection or test data.

- i. Test results and an interpretations of test results.
- j. Ambient conditions at the time of sample-taking and testing.
- k. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
- I. Name and signature of laboratory inspector.
- m. Recommendations on retesting.

### 1.5 QUALITY ASSURANCE

- A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
  - 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.
- PART 2 PRODUCTS (Not Applicable).

## PART 3 - EXECUTION

- 3.1 REPAIR AND PROTECTION
  - A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
  - B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
  - C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01400

## SECTION 01500 - TEMPORARY FACILITIES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
- B. Temporary utilities required include but are not limited to:
  - 1. Water service and distribution.
  - 2. Temporary electric power and light.
  - 3. Telephone service.
- C. Temporary construction and support facilities required include but are not limited to:
  - 1. Temporary heat.
  - 2. Field offices and storage sheds.
  - 3. Temporary roads and paving.
  - 4. Sanitary facilities, including drinking water.
  - 5. Dewatering facilities and drains.
  - 6. Temporary enclosures.
  - 7. Hoists.
  - 8. Temporary Project identification signs and bulletin boards.
  - 9. Waste disposal services.
  - 10. Rodent and pest control.
  - 11. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities required include but are not limited to:
  - 1. Temporary fire protection.

- 2. Barricades, warning signs, lights.
- 3. Environmental protection.
- E. Assignment of temporary facility responsibility:

1. GC to provide temporary heat, lights, telephone, and sanitary facilities. He is also responsible for paying the utility bill.

2. Electrical Contractor to provide temporary electrical power service at the start of construction.

3. Plumbing Contractor to provide water service to the building at the start of construction.

- 1.3 SUBMITTALS
  - A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.
  - B. Implementation and Termination Schedule: Submit a schedule indicating implementation and termination of each temporary utility within 15 days of the date established for commencement of the Work.

#### 1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
  - 1. Building Code requirements.
  - 2. Health and safety regulations.
  - 3. Utility company regulations.
  - 4. Police, Fire Department and Rescue Squad rules.
  - 5. Environmental protection regulations.
- B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."
  - 1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.
  - 2. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

### 1.5 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

#### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General: Provide new materials; if acceptable to the Owner, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Lumber and Plywood: Comply with requirements in Division-6 Section "Rough Carpentry."
  - 1. For job-built temporary offices, shops and sheds within the construction area, provide UL labeled, fire treated lumber and plywood for framing, sheathing and siding.
  - 2. For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thickness indicated.
  - 3. For fences and vision barriers, provide exterior type, minimum 3/8" thick plywood.
  - 4. For safety barriers, sidewalk bridges and similar uses, provide minimum 5/8" thick exterior plywood.
- C. Paint: Comply with requirements of Division-9 Section "Finish Painting."
  - 1. For job-built temporary offices, shops, sheds, fences and other exposed lumber and plywood, provide exterior grade acrylic-latex emulsion over exterior primer.
  - 2. For sign panels and applying graphics, provide exterior grade alkyd gloss enamel over exterior primer.
  - 3. For interior walls of temporary offices, provide two coats interior latex flat wall paint.

- D. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- E. Water: Provide potable water approved by local health authorities.
- F. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel pipe posts, 1-1/2" I.D. for line posts and 2-1/2" I.D. for corner posts.

## 2.2 EQUIPMENT

- A. General: Provide new equipment; if acceptable to the Owner, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows and serviceable finishes. Provide heated and air- conditioned units on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.
- I. First Aid Supplies: Comply with governing regulations.
- J. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide

hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
  - 1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
  - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
  - 3. Obtain easements to bring temporary utilities to the site, where the Owner's easements cannot be used for that purpose.
  - 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner, and will not be accepted as a basis of claims for a Change Order.
- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
  - 1. Sterilization: Sterilize temporary water piping prior to use.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.
  - 1. Except where overhead service must be used, install electric power service underground.
  - 2. Power Distribution System: Install wiring overhead, and rise vertically where

least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

- D. Temporary Lighting: Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.
  - 1. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period. Install telephone on a separate line for each temporary office and first aid station. Where an office has more than two occupants, install a telephone for each additional occupant or pair of occupants.
  - 1. At each telephone, post a list of important telephone numbers.
- F. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off the site in a lawful manner.
  - 1. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.
  - 2. Connect temporary sewers to the municipal system as directed by the sewer department officials.
  - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
- G. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

## 3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
  - 1. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from

adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

- C. Heating Facilities: Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
- D. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:
- E. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on the site.
- F. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
  - 1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
- G. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
- H. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper supply.
- I. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division-2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations and construction free of water.
- J. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
  - 1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

- 2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
- 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.
- K. Project Identification and Temporary Signs: Prepare project identification and other signs of the size indicated; install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood or steel. Do not permit installation of unauthorized signs.
  - 1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
  - 2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- L. Temporary Exterior Lighting: Install exterior yard and sign lights so that signs are visible when Work is being performed.
- M. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.
- N. Rodent and Pest Control: Before deep foundation Work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be relatively free of pests and their residues at Substantial Completion. Perform control operations in a lawful manner using environmentally safe materials.

## 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Owner.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
  - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.

- 2. Store combustible materials in containers in fire-safe locations.
- 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
- 4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
- E. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.
  - 1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- F. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

## 3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.
  - 2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

- C. Termination and Removal: Unless the Owner requests that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the 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 the Contractor. The Owner reserves the right to take possession of Project identification signs.
  - 2. Remove temporary paving that is not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances which might impair growth of plant materials or lawns. Repair or replace street paving, curbs and sidewalks at the temporary entrances, as required by the governing authority.
  - 3. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
    - a. Replace air filters and clean inside of ductwork and housings.
    - b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
    - c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

END OF SECTION 01500

### SECTION 01600 - MATERIALS AND EQUIPMENT

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section "Submittals."
- C. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.
- D. Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section "Product Substitutions."

#### 1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms such are self-explanatory and have well recognized meanings in the construction industry.
  - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
    - a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
    - b. "Foreign Products", as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside of the United States and its possessions; or produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of nor living within the United States and its possessions.
  - 2. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

### 1.4 SUBMITTALS

- A. Product List Schedule: Prepare a schedule showing products specified in a tabular form acceptable to the Owner. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.
  - 1. Coordinate the product list schedule with the Contractor's Construction Schedule and the Schedule of Submittals.
  - 2. Form: Prepare the product listing schedule with information on each item tabulated under the following column headings:
    - a. Related Specification Section number.
    - b. Generic name used in Contract Documents.
    - c. Proprietary name, model number and similar designations.
    - d. Manufacturer's and name and address.
    - e. Supplier's name and address.
    - f. Installer's name and address.
    - g. Projected delivery date, or time span of delivery period.
  - 3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.
    - a. At the Contractor's option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.
  - 4. Completed Schedule: Within 60 days after date of commencement of the Work, submit 3 copies of the completed product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.
  - 5. Owner's Action: The Owner will respond in writing to the Contractor within 2 weeks of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or products, but does not constitute a waiver of the requirement that products comply with Contract Documents. The Owner's response will include the following:
    - a. A list of unacceptable product selections, containing a brief explanation of reasons for this action.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
  - 1. When specified products are available only from sources that do not or cannot produce a quantity adequate to complete project requirements in a timely

manner, consult with the Owner for a determination of the most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources that produce products that possess these qualities, to the fullest extent possible.

- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
  - 1. Single prime Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of separate Contractors.
  - 2. If a dispute arises over incompatible products, the Owner will determine which products shall be retained and which are incompatible and must be replaced.
- C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:
  - 1. No available domestic product complies with the Contract Documents.
- D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
  - 1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
  - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
    - a. Name of product and manufacturer.
    - b. Model and serial number.
    - c. Capacity.
    - d. Speed.
    - e. Ratings.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.
  - 1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

- 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
- 3. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
- 4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
- 5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
- 6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
- 7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

## PART 2 - PRODUCTS

## 2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
  - 1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
  - 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
  - 1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
  - 2. Semiproprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.

- a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
- 3. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
- 4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
- 5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.
  - a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
- 6. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
- 7. Visual Matching: Where Specifications require matching an established Sample, the Owner's decision will be final on whether a proposed product matches satisfactorily.
  - a. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.
- 8. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Owner will select the color, pattern and texture from the product line selected.
- 9. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division-1 for allowances that control product selection, and for procedures required for processing such selections.

## PART 3 - EXECUTION

## 3.1 INSTALLATION OF PRODUCTS:

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
  - 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01600

## SECTION 01631 - PRODUCT SUBSTITUTIONS

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section "Submittals."
- C. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.
- D. Procedural requirements governing the Contractor's selection of products and product options are included under Section "Materials and Equipment."

#### 1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions." The following are not considered substitutions:
  - 1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
  - 2. Revisions to Contract Documents requested by the Owner.
  - 3. Specified options of products and construction methods included in Contract Documents.
  - 4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

#### 1.4 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if

received within 60 days after commencement of the Work. Requests received more than 60 days after commencement of the Work may be considered or rejected at the discretion of the Owner.

- 1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
- Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
  - a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
  - b. Samples, where applicable or requested.
  - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
  - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.
  - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
  - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
  - g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
- 3. Owner's Action: Within one week of receipt of the request for substitution, the Owner will request additional information or documentation necessary for evaluation of the request. Within 2 weeks of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Owner will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name.

Acceptance will be in the form of a Change Order.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Conditions: The Contractor's substitution request will be received and considered by the Owner when one or more of the following conditions are satisfied, as determined by the Owner; otherwise requests will be returned without action except to record noncompliance with these requirements.
  - 1. Extensive revisions to Contract Documents are not required.
  - 2. Proposed changes are in keeping with the general intent of Contract Documents.
  - 3. The request is timely, fully documented and properly submitted.
  - 4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
  - 5. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
  - 6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
  - 7. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Owner for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
  - 8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
  - 9. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
  - 10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
  - 11. Where a proposed substitution involves more than one prime Contractor, each

Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.

- B. The Contractor's submittal and Owner's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.
- PART 3 EXECUTION (Not Applicable)

END OF SECTION 01631

## SECTION 01700 - PROJECT CLOSEOUT

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
  - 1. Inspection procedures.
  - 2. Project record document submittal.
  - 3. Operating and maintenance manual submittal.
  - 4. Submittal of warranties.
  - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions-2 through -16.

#### 1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
  - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
  - 2. Advise Owner of pending insurance change-over requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

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- 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
- 5. Deliver tools, spare parts, extra stock, and similar items.
- 6. Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.
- 7. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
- 8. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
  - 1. The Architect will repeat inspection when requested and assured that the Work has been substantially completed.
  - 2. Results of the completed inspection will form the basis of requirements for final acceptance.

## 1.4 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
  - 1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
  - 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
  - 3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
  - 4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
  - 5. Submit consent of surety to final payment.

- 6. Submit a final liquidated damages settlement statement, if any.
- 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Architect will reinspect the Work upon receipt of written notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.
  - 1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
  - 2. If necessary, reinspection will be repeated.

## 1.5 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
  - 1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
  - 2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
  - 3. Note related Change Order numbers where applicable.
  - 4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

- 1. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
  - 1. Upon completion of mark-up, submit complete set of record Product Data to the Architect for the Owner's records.
- E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.
- G. Maintenance Manuals: (Maintenance Manuals are required for General, Plumbing, HVAC, Electrical and Kitchen Equipment contracts.) Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information; provide 2 copies of General Construction Manuals, 3 copies of all other contracts:
  - 1. Emergency instructions.
  - 2. Spare parts list.
  - 3. Copies of warranties.
  - 4. Wiring diagrams.
  - 5. Recommended "turn around" cycles.
  - 6. Inspection procedures.
  - 7. Shop Drawings and Product Data.
  - 8. Fixture lamping schedule.
- PART 2 PRODUCTS (Not Applicable)

PART 3 - EXECUTION

PROJECT CLOSEOUT

## 3.1 CLOSEOUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of at lease the following items:
  - 1. Maintenance manuals.
  - 2. Record documents.
  - 3. Spare parts and materials.
  - 4. Tools.
  - 5. Lubricants.
  - 6. Fuels.
  - 7. Identification systems.
  - 8. Control sequences.
  - 9. Hazards.
  - 10. Cleaning.
  - 11. Warranties and bonds.
  - 12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
  - 1. Start-up.
  - 2. Shutdown.
  - 3. Emergency operations.
  - 4. Noise and vibration adjustments.
  - 5. Safety procedures.
  - 6. Economy and efficiency adjustments.
  - 7. Effective energy utilization.

#### 3.2 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
  - 1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion. Additional cleaning may be required if work required after substantial completion creates dust, dirt, etc.
    - a. Remove labels that are not permanent labels.
    - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
    - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free

condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

- d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
- e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C. Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.
- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
  - 1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01700

## SECTION 01740 - WARRANTIES AND BONDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.
  - 1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.
  - 2. General closeout requirements are included in Section "Project Closeout."
  - 3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions-2 through -16.
  - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- C. Single Prime Contract: Single prime Contractor is responsible for warranties related to the Contract.

#### 1.3 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract
Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

## 1.4 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
  - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

## 1.5 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. If the Owner's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.
  - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen days of completion of that designated portion of the Work.

B. When a special warranty is required to be executed by the Contractor, or the Contractor

and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Owner for approval prior to final execution.

- 1. Refer to individual Sections of Divisions-2 through -16 for specific content requirements, and particular requirements for submittal of special warranties.
- C. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
  - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
  - 2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS, the Project title or name, and the name of the Contractor.
  - 3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
- PART 2 PRODUCTS (not applicable).

# PART 3 - EXECUTION

# 3.1 SCHEDULE OF WARRANTIES

A. Schedule: Provide warranties and bonds on products and installations as specified in the following Sections:

Termite Control Treatment:	Section 02280 - Termite Control
Wood Doors:	Section 08211 - Wood Doors
Aluminum Windows:	Section 08520 - Aluminum Windows
Insulating Glass:	Section 08800 - Glass and Glazing

Carpet:	Section 09680 - Carpet
Water Heaters:	Section 15458 - Water Heaters
Packaged Heating and Cooling Units:	Section 15781 - Packaged Heating

END OF SECTION 01740

## SECTION 02115

## SOIL EROSION AND SEDIMENT CONTROL

### PART 1 – GENERAL:

#### 1.1 SUMMARY:

- A. This Section includes the following:
- 1 Erosion control during construction.
- 2 Temporary seeding and mulching.

### B. Related Sections include the following:

1. Section 02300-Earthwork

### **1.2 SYSTEM DESCRIPTION:**

- A. The extent of soil erosion and sediment control is shown on the drawings and specified herein and generally includes the installation of erosion control devices as shown, maintenance of erosion control devices during construction, and removal at completion. Temporary seeding of disturbed areas is also included in this Section.
- B. Intent and Procedures:

1 General: Contractor shall do all that is possible to minimize soil erosion and siltation caused by construction operations. The North Carolina Sedimentation Control Commission's Erosion and Sediment Control Planning and Design Manual Practice Standards and Specifications are minimum requirements. Comply with all applicable regulations relating to the control of soil erosion and prevention of sedimentation pollution. The Contractor shall be fully informed regarding all regulations which affect the conduct of the work, and shall comply with such regulations at all times.

2 Prior to the beginning of soil surface disturbing activities, temporary soil erosion control measures and devices shall be placed as indicated at the areas affected by the land-disturbing activities. Contractor will lay out devices by staking and schedule a site meeting with authorities having jurisdiction to approve erosion control measures prior to installation.

3 Surface water run-off originating upgrade from exposed areas should be controlled to reduce erosion in sediment loss during the period of exposure. All land-disturbing activities are to be planned and conducted so as to minimize off-site sedimentation damage. The Contractor shall conduct his activities in a manner which will prevent sediment from reaching streams flowing off site and will prevent increased velocities and peak rates of storm water runoff from resulting in erosion along receiving streams.

4 During the land-disturbing activities, all actions shall be planned and conducted to

minimize the size of any area to be exposed at any one time and to limit exposure to the shortest feasible time.

5. All disturbed areas shall be temporarily seeded for erosion protection within twenty-one (21) calendar days on any portion upon which active construction is no longer being undertaken. Every effort possible shall be made to bring each segment of the site to a stable state as quickly as possible, thus minimizing erosion potential.

6. Additional erosion control measures may be required by the authorities having jurisdiction that are not shown on the plans. It is the contractor's responsibility to maintain erosion onsite, regardless of the measures required. Any change in the erosion control measures and/or grading shall be called to the attention of the engineer and the authorities having jurisdiction.

7. Weather forecast shall be monitored. The contractor shall prepare for rain events by reexamining all erosion control measures prior to start of precipitation. Any re-enforcement or corrections should be performed and documented.

8. If fill materials are to be brought onto this project or waste materials are to be taken from this project, this information shall be disclosed and shown on the erosion control and grading plan. Borrow areas and dump sites are considered to be part of this project and the property owner of the borrow or dump site is responsible for stabilization and erosion control measures at these sites.

9. All construction sites one (1) acre or more, require a NPDES permit. Therefore:

a. Written documentation of a deviation from approved plan shall be noted on the approved plans.

b. Written documentation of an emergency situation where sediment has been discharged off site shall be recorded. Also, contractor's actions to repair and return area to prestorm condition shall be recorded.

c. The permittee shall inspect all erosion and sedimentation control facilities every seven days and within 24 hours of a 0.5 inch or greater of rain. Findings shall be recorded and presented upon request of the authorities having jurisdiction.

d. The contractor shall provide rain-recording device and record each rainfall.

e. Any failures that cause visible sedimentation to leave the approved disturbed limits shall be corrected immediately and documented.

f. A copy of the NPDES permit shall be kept on site for reference.

10. The authorities having jurisdiction can require, in addition to any other civil or criminal penalty or injunctive relief, that any person(s) who is engaged in a land-disturbing activity and fails to retain sediment generated by the land-disturbing activity, to restore the waters and land affected by the failure so as to minimize the detrimental effects of the resulting pollution. The Contractor may be held liable for any costs, fines or penalties incurred due to any "Notice of Violation" issued by the authorities having jurisdiction if the violation is a result of not following the approved plan, not making repairs or correction as directed within the specified timeframe, for failure to maintain the devices, or for any other deficiency noted in the Notice of Violation that is a result of the contractor's actions. The Contractor will not be held liable for any costs, fines or penalties incurred due to any "Notice of Violation" issued by the authorities having noted in the Notice of Violation that is a result of the contractor's actions. The Contractor will not be held liable for any costs, fines or penalties incurred due to any "Notice of Violation" issued by the authorities having jurisdiction if the violation is a result of circumstances beyond the control of the Contractor.

# PART 2-PRODUCTS:

# 2.1 SILT FENCE:

A. Silt fence fabric shall be, industrial propylene fabric and reinforcement netting stitched together, or other suitable material as approved by the soil erosion control agency

maintaining jurisdiction over this site.

B. Silt fence reinforcing wire shall be agricultural quality annealed steel #14 W & W ga. wire with open web pattern of 4" x 5" spacing maximum. Place wire support behind fabric. Silt fence supports shall be solid, steel "T"-shaped posts.

#### 2.2 TEMPORARY SEEDING:

- A. Temporary seeding including fertilizer, limestone and mulch is required to temporarily anchor all disturbed earth and erosion ditches during construction. Seeding schedule is as follows:
- B. Temporary Seeding Schedule:

Date	Type	Planting Rate
Mar 1-Jun 1	Sericea Lespedeza (scarified) and	50 lbs/acre
	Tall Fescue	120 lbs/acre
Jun 1 – Sep 1	Tall Fescue and	120 lbs/acre
	Brownrtop Millet	35 lbs/acre
	Or Sorghum-Sudan Hybrids	30 lbs/acre
Sep 1 – Mar 1	Sericea Lespedeza (unhulled-unscarified) and	70 lbs/acre
	Tall Fescue	120lbs/acre

#### 2.3 SOIL AMENDMENTS:

- A. Limestone: Agricultural ground limestone shall be dolomitic type NCDOT Section 960-2.
- B. Fertilizer: NCDOT Section 960-1. Fertilizer composition shall be approved by the Architect prior to spreading and shall be dry and free flowing, and shall be delivered to the site in the guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged making it unsuitable for use, will not be accepted. Fertilizer shall not have been exposed to weather prior to delivery until used, it shall be completely protected at all times. It shall not be stored in direct contact with the ground.
- C. Mulch: A protective cover shall be placed over all newly seeded areas. It shall consist of either hay, straw, wood cellulose fiber and tacked with non-toxic asphaltic emulsion. All mulch shall be free of noxious weeds, mold, or other objectionable material. Straw and hay shall be in an air-dry condition and suitable for placing with mulch blower equipment.
- D. Asphalt Emulsion Tackifier: Asphalt emulsion, ASTM D 977, Grade SS-1, nontoxic and free of plant growth-or germination-inhibitors.

### 2.4 EROSION CONTROL MATERIALS:

A. Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Excelsior matting shall have mesh on both sides of blanket and shall have a minimum shear strength of 2 psf. Include manufacturer's

recommended steel wire staples, 6 inches long.

#### 2.5 MISCELLANEOUS:

- A. Concrete Unit Masonry (CMU) units shall be used for catch basin protection as detailed.
- B. Stone for construction entrance(s) shall be as detailed on the drawings.

#### PART 3 – EXECUTION:

# 3.1 CONSTRUCTION OF TEMPORARY DEVICES:

- A. Stone construction entrance(s) shall be constructed as shown on the drawings. Maintain stone construction entrance(s) throughout the construction period to prevent mud from being tracked onto the adjoining roads.
- B. Silt fences shall be constructed of length and configuration necessary to protect against contamination and erosion. Maintain until the work under this Contract is complete. Silt fence shall be installed with the bottom 6" of the fabric placed in a 6" deep trench and backfilled with washed stone to prevent undermining of the silt fence. The silt fabric, fence

and posts shall be maintained in good working order throughout the period of the Contract. Apply silt fabric on uphill side of posts with enough wire clips to prevent slippage or sagging under full load.

C. Catch basin protection shall be constructed so that CMU anchors stone in place and both work together to filter sediment from runoff. Maintain protection until stand of grass has covered soil.

## 3.2 SEEDING AND MULCHING:

- A. Fertilizer shall be distributed evenly by mechanical spreader, worked into the top 4" of topsoil not more than one week prior to seeding operations. Spread at the rate of 500 lbs. per acre. Broadcast 1/2 of fertilizer in one direction and the remaining 1/2 in a direction at right angles to the first direction.
- B. Limestone shall be spread at a rate of 2000 lbs. per acre, unless recommended otherwise by a soil analysis.
- C. Temporary seeding shall be placed with mechanical seeders. Rake or scarify ground areas prior to the start of the seeding operation. Sow equal quantities in two directions at right angles to each other to assure an even distribution over the entire area.
- D. Mulch shall be spread uniformly over seeded areas at the rate of 75 to 100 lbs./1,000 sq. ft. The mulch shall be anchored with the mulch tiller, or if the area is not acceptable, asphalt emulsion may be used as tiedown or adhesive, Type SS-1 or approved equal shall be applied either simultaneously with the straw or hay or in a separate operation. The Contractor shall take precautionary measures to prevent asphalt adhesive materials from marking or defacing structures, pavements, utilities or plants.

# 3.3 REMOVAL OF TEMPORARY DEVICES:

A. Silt Fences and Other Temporary Devices: After completion of site work under this Contract, and a satisfactory stand of grass has been approved the Contractor is to remove silt fences, catch basin protection and other erosion control devices and legally dispose of SOIL EROSION AND SEDIMENT CONTROL 02115 - 4

# END OF SECTION 02115

### SECTION 02230

#### SITE CLEARING

## PART 1 -GENERAL

#### 1.1 SUMMARY

- A. Section includes removal of surface debris; removal of paving, curbs and gutters; removal of trees, shrubs, and other plant life.
- B. Related Sections:
- 1 Section 02115 Soil Erosion and Sediment Control.
- 2 Section 02300 -Earthwork

PART 2 -PRODUCTS Not Used.

#### PART 3 - EXECUTION

#### **3.1 PREPARATION**

- A. Division 1 Section -Administrative Requirements: Coordination and project conditions.
- B. Verify that existing plant life designated to remain is tagged or identified.

## **3.2 PROTECTION**

- A. Locate, identify, and protect utilities that remain, from damage.
- B. Protect trees, plant growth, and features designated to remain, as final landscaping.
- C. Protect bench marks, survey control points, and existing structures from damage or displacement.

#### 3.3 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove trees and shrubs within marked areas. Remove stumps.
- C. Clear undergrowth and deadwood, without disturbing subsoil.
- 3.4 REMOVAL A. Remove debris, rock, and extracted plant life from site.
- B. Partially remove paving, curbs, and walks; as indicated. Neatly saw cut edges at right angle to surface.

END OF SECTION

# SECTION 02700 - TERMITE CONTROL

# 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 soil treatment for termite control.

## 1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Product data and application instructions.
- C. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.

### 1.4 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.
- B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.
- C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

# 1.5 JOB CONDITIONS

- A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.
- B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

# 1.6 WARRANTY

TERMITE CONTROL

- A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.
- B. Warranty Period: 5 years from date of Substantial Completion.
- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

## PART 2 - PRODUCTS

- 2.1 SOIL TREATMENT SOLUTION
  - A. General: Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termites infestation. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements.
  - B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
    - 1. Chloropyrifos: 1.0% in water emulsion.
      - a. Dursban TC, Dow Chemical Co.
    - 2. Permathrin: 0.5% in water emulsion.
      - a. Dragnet FT, FMC Corp.
      - b. Torpedo, ICI Americas, Inc.
  - C. Dilute with water to concentration level recommended by manufacturer.
  - D. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.
- PART 3 EXECUTION

## 3.1 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied

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before placing compacted fill under slabs if recommended by toxicant manufacturer.

- B. Application Rates: Apply soil treatment solution as follows:
  - 1. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following application rates:
    - a. Apply 4 gallons of chemical solution per 10 linear feet to soil in critical areas under slab, including entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.
    - b. Apply 1 gallon of chemical solution per 10 sq. ft. as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallons of chemical solution to areas where fill is washed gravel or other coarse absorbent material.
    - c. Apply 4 gallons of chemical solution per 10 linear feet of trench for each foot of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches wide along outside of foundation to a depth of not less than 12 inches. Punch holes to top of footing at not more than 12 inches o.c. and apply chemical solution. Mix chemical solution with the soil as it is being replaced in the trench.
  - 2. At hollow masonry foundations or grade beams, treat voids at rate of 2 gallons per 10 linear feet, poured directly into the hollow spaces.
  - 3. At expansion joints, control joints, and areas where slabs will be penetrated, apply at rate of 4 gallons per 10 linear feet of penetration.
- C. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs after areas are covered by other construction.
- D. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION 02700

# SECTION 02300

## EARTHWORK

# PART 1 -GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
- 1. Preparing subgrades pavements, lawns, and plantings.
- 2. Excavating and backfilling trenches for buried utilities and buried utility structures.
- 3. Unit price for rock, trench rock and unsuitable soil excavation.
- 4. Provide dewatering required to protect subgrade.

B. Related Sections include the following:

- 1 Section 02115 "Soil Erosion and Sediment Control".
- 2 Section 02230 "Site Clearing".

### 2.1 UNIT PRICES

- A. Rock and Trench Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following:
- 1 24 inches outside of concrete forms other than at footings.
- 2 12 inches outside of concrete forms at footings.
- 3 6 inches outside of minimum required dimensions of concrete cast against grade.

Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior

waterproofing treatments.

- 4 6 inches beneath bottom of concrete slabs on grade.
- 5 6 inches beneath pipe in trenches, and 24 inches wider than pipe.
- B. Unit prices shall be as stated in the bid per Specification Section 01200. Unit prices for rock, trench rock and unsuitable soil material include replacement with approved materials.

### 2.2 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

- 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
- 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of water.

E. Excavation: Removal of material encountered above subgrade elevations.

Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.

3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1 Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 lbf and stick-crowd force of not less than 18,700 lbf; measured according to SAE J-1179.

2 Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 45,000-lbf breakout force; measured according to SAE J-732.

- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.
- J. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

# 2.3 SUBMITTALS

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1 Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.

2 Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.

### 2.4 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated:
- 1 Notify Architect not less than two days in advance of proposed utility interruptions.
- 2 Do not proceed with utility interruptions without Architect's written permission.
- 3 Contact utility-locator service for area where Project is located before excavating.

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B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with Owner to shut off services if lines are active.

## PART 3 - PRODUCTS

## 3.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 soil classification groups CL, GC, SC, GW, GP, GM, ML, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups, MH, CH, OL, OH, and PT, or a combination of these group symbols.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 3 percent of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials.
- E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate grading size 57, with 100 percent passing a 1-1/2-inch sieve and not more than 5 percent passing a No. 8 sieve.

### PART 4 -EXECUTION

#### 4.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

#### 4.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

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1 Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2 Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

#### 4.3 EXPLOSIVES

A. Explosives: The use of explosive is prohibited

#### 4.4 EXCAVATION, GENERAL

A. Classified Excavation: The following classifications of excavation will be made when rock excavation is encountered in work:

1 Earth Excavation: Earth excavation includes excavation of earth and other materials encountered that are not classified as rock, trench rock, unsatisfactory or unauthorized excavation

2 Trench Rock Excavation: Includes removal, disposal of materials and obstructions encountered which cannot be excavated with equipment specified. Payment for trench rock excavation shall be on the basis of the unit price stated on the bid form. Field measurements shall be determined by the Owner's soil testing service and verified by the Architect and Owner. Payment of trench rock shall include replacement with suitable materials.

3 Rock Excavation: Includes removal and disposal of materials and obstructions encountered which cannot be disloged and excavated with equipment specified. Rock materials include boulders ½ cubic yard or more in volume, solid rock, rock in ledges, and rock hard cementitious aggregate deposits. Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation shall be classified as earth excavation. Payment for rock excavation will be on the basis of the unit price stated on the bid form. Field measurements shall be determined by the Owner's soil testing service and verified by the Architect and Owner. Payment of rock excavation shall include replacement with suitable materials.

### 4.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades

#### 4.6 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
- 1. Clearance: 12 inches on each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1 For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

2 For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.

3 Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

#### 4.7 APPROVAL OF SUBGRADE AND UNSATISFACTORY MATERIAL

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Excavation of unsatisfactory soil materials and replacement material will be paid for for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
- D. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect

#### 4.8 UNAUTHORIZED EXCAVATION

A. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without the specific direction of the Architect. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect. Unauthorized excavations will be filled at no additional cost to the Owner.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect at no additional cost to the Owner.

#### 4.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

#### 4.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1 Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.

- 2 Surveying locations of underground utilities for record documents.
- 3 Inspecting and testing underground utilities.
- 4 Removing concrete formwork.
- 5 Removing trash and debris.
- 6 Removing temporary shoring and bracing, and sheeting.
- 7 Installing permanent or temporary horizontal bracing on horizontally supported walls.

#### 4.11 UTILITY TRENCH BACKFILL

- A. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.
- B. Coordinate backfilling with utilities testing.
- C. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- D. Place and compact final backfill of satisfactory soil material to final grade.

### 4.12 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as indicated.

#### 4.13 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 3 percent of optimum moisture content.
- 1 Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2 Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

#### 4.14 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1 Under structures, steps, and pavements, scarify and recompact top 12 inches of existing subgrade, backfill or fill material at 100 percent. Below top 12 inches at 95 percent

2 Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 95 percent.

3 Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 90 percent.

### 4.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

- 1 Provide a smooth transition between adjacent existing grades and new grades.
- 2 Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
- 1 Lawn or Unpaved Areas: Plus or minus 1 inch.
- 2 Walks: Plus or minus 1 inch.
- 3 Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge

### 4.16 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1 Building Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2500 sq. ft. or less of building slab, but in no case fewer than three tests.

2 Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 5000 sq. ft. or less of paved area, but in no case fewer than two tests.

3 Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 300 feet or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

# 5.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with

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additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

## 5.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

# END OF SECTION 02300

## SECTION 02630

### STORM DRAINAGE SYSTEMS

#### PART 1 – GENERAL

#### 1.1 SUMMARY:

- A. This Section includes storm drainage 5 feet outside the building line. Systems include the following:
  1. Storm drainage.
- B. Related Sections include the following:
- 1 Section 02115-Soil Erosion and Sediment Control
- 2 Section 02300-Earthwork

#### 1.2 DEFINITIONS:

- A. RCP: Reinforced concrete pipe.
- B. PE: Polyethylene plastic.

#### 1.3 SUBMITTALS:

- A. Product Data: For the following:
- 1. Reinforced concrete pipe and fittings.
- 2. Polyethylene Plastic Pipe and fittings.
  - B. Shop Drawings: Include plans, elevations, details, and attachments for the following:
- 1 Precast concrete manholes and other structures, including frames, covers, and grates.
- 2 Frames, covers, and grates for cast-in-place manholes and other structures.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

#### 1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Protect pipe, pipe fittings, and seals from dirt and damage.
- B. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

## **1.5 ROJECT CONDITIONS:**

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services

#### STORM DRAINAGE SYSTEMS

according to requirements indicated:

- 1 Notify Architect not less than two days in advance of proposed utility interruptions.
- 2 Do not proceed with utility interruptions without Architect's written permission.

# PART 2 – PRODUCTS

## 2.1 PIPES AND FITTINGS:

A. Reinforced-Concrete Sewer Pipe and Fittings (15 inch diameter and larger): ASTM C 76, Class III, Wall for gasketed joints.

1. Gaskets: ASTM C 443, rubber.

B. Corrugated PE Pipe and Fittings (4 inch thru 10 inch): AASHTO M 252, Type S, with smooth waterway for coupling joints.

1 Soiltight Couplings: AASHTO M 252, corrugated, matching tube and fittings to form soiltight joints.

2 Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings to form silttight joints.

C. Corrugated PE Pipe and Fittings (12 inch thru 36 inch): AASHTO M 294, Type S, with smooth waterway for coupling joints.

1 Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings to form soiltight joints.

2 Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings to form silttight joints.

# 2.2 SPECIAL PIPE COUPLINGS AND FITTINGS:

- A. Sleeve-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for nonpressure joints.
- 1 Sleeve Material for Concrete Pipe: ASTM C 443, rubber.
- 2 Sleeve Material for Cast-Iron Soil Pipe: ASTM C 564, rubber.
- 3 Sleeve Material for Plastic Pipe: ASTM F 477, elastomeric seal.
- 4 Sleeve Material for Dissimilar Pipe: Compatible with pipe materials being joined.

# 2.3 CATCH BASINS:

- A. Construct catch basins as indicated.
- 1 Frames and Grates: ASTM A 48, Class 30 minimum, gray-iron casting.

2 Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A 615/A 615M and encased in polypropylene complying with ASTM D 4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12-to 16-inch intervals.

#### 2.4 CONCRETE:

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
- 1 Cement: ASTM C 150, Type II.
- 2 Fine Aggregate: ASTM C 33, sand.
- 3 Coarse Aggregate: ASTM C 33, crushed gravel.
- 4 Water: Potable.
  - B. Portland Cement Design Mix: 3000 psi minimum, with 0.45 maximum water-cementitious ratio.
- 1 Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
- 2 Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.
  - C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water-cementitious ratio.

#### 2.5 CLEANOUTS:

A. ASME A112.36.2M, round, cast-iron housing with clamping device and round, secured, scoriated castiron cover. Include cast-iron ferrule with inside caulk or spigot connection and countersunk, taperedthread, brass closure plug..

### PART 3 – EXECUTION

### 3.1 EARTHWORK:

A. Excavating, trenching, and backfilling are specified in Section 02300 "Earthwork."

#### 3.2 INSTALLATION, GENERAL:

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

- C. Use junction boxes for changes in direction, unless otherwise indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.
- 1 Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
- 2 Install piping with 18-inch minimum cover.
  - F. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

## 3.3 PIPE JOINT CONSTRUCTION AND INSTALLATION:

- A. General: Join and install pipe and fittings according to installations indicated.
- B. Install with top surfaces of components, except piping, flush with finished surface.
- C. Concrete Pipe and Fittings: Install according to ACPA's "Concrete Pipe Installation Manual." Use the following seals:
  - 1. Round Pipe and Fittings: ASTM C 443, rubber gaskets.

D. PE Pipe and Fittings: As follows:

1 Join pipe, tubing, and fittings with couplings for soiltight joints according to manufacturer's written instructions.

2 Install according to ASTM D 2321 and manufacturer's written instructions.

3 Install corrugated piping according to the Corrugated Polyethylene Pipe Association's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

E. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

### 3.4 CATCH-BASIN INSTALLATION:

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

### 3.5 CONCRETE PLACEMENT:

A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

### 3.6 FIELD QUALITY CONTROL:

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
- 1 In large, accessible piping, brushes and brooms may be used for cleaning.

#### STORM DRAINAGE SYSTEMS

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- 2 Place plug in end of incomplete piping at end of day and when work stops.
- 3 Flush piping between structures to remove collected debris, if required by authorities having jurisdiction.
  - B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
- 1. Submit separate reports for each system inspection.
- 2. Defects requiring correction include the following:
- a. Alignment: Less than full diameter of inside of pipe is visible between structures.
- b. Crushed, broken, cracked, or otherwise damaged piping.
- c. Infiltration: Water leakage into piping.
- d. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

- 4. Reinspect and repeat procedure until results are satisfactory.
  - C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
- 1 Do not enclose, cover, or put into service before inspection and approval.
- 2 Test completed piping systems according to authorities having jurisdiction.
- 3 Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
- 4 Submit separate reports for each test.
- 5 Leaks and loss in test pressure constitute defects that must be repaired.

6 Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

## END OF SECTION 02630

# SECTION 03300 - CAST-IN-PLACE CONCRETE

# PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

# 1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.
- B. Extent of concrete work is shown on drawings and includes sidewalks.

## 1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections. Contractor is to review and stamp shop drawings before submitting for approval.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, and others as requested by Architect.
- C. Shop drawings for reinforcement, prepared by registered Professional Engineer for fabrication, bending, and placement of concrete reinforcement. Comply with ACI SP-66 (88), "ACI Detailing Manual," showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures. Show foundations in plan. Show wall and pier reinforcing in elevation. Include all pertinent details and schedules required to specify the reinforcing.
- D. Samples of materials as requested by Architect, including names, sources, and descriptions, as follows:
  - 1. Normal weight aggregates.
  - 2. Reglets.
  - 3. Vapor retarder.
- E. Submit laboratory test reports for concrete materials and mix design tests as specified, and results of on-site materials testing.
- F. Materials certificates in lieu of materials laboratory test reports when permitted by Architect. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

# 1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
  - 1. ACI 318, "Building Code Requirements for Reinforced Concrete" with included references and associated applicable ACI and ASTM publications.
  - 2. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
  - 3. American Welding Society AWS D 1.4 "Recommended Practice for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction."
  - 4. North Carolina State Building Code, including all amendments.
- B. Concrete Testing Service: Contractor is to engage a testing laboratory acceptable to Architect to perform material evaluation tests and to design concrete mixes.
- C. Materials and installed work may require testing and retesting at any time during progress of work. Allow free access to material stockpiles and facilities. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.
- D. Pre-Construction Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings".

# PART 2 - PRODUCTS

# 2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, forms shall be used for exposed concrete surfaces to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
  - 1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I, for permanently exposed work.
  - 2. For unexposed work use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Coatings: Provide commercial formulation form-coating compounds with a maximum VOC of 350 mg/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- D. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal.

Provide units that will leave no metal closer than 1-1/2 inches to exposed surface.

1. Provide ties that, when removed, will leave holes not larger than 1-inch diameter in concrete surface.

## 2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Plain Steel Dowels: ASTM A 306 with a minimum yield stress of 40,000 psi.
- C. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- D. Welded Wire Fabric: ASTM A 185, welded steel wire fabric. Provide in mat form where specified.
- E. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar-type supports complying with CRSI specifications.
  - 1. For slabs-on-grade, pull wire mesh into location on small mounds of concrete placed directly ahead of the concrete mass pour.
  - 2. For concrete footings, support on chairs, spaced at 4'-0" and driven a minimum of 1'-0" into the ground.
  - 3. Tie Wire: Shall be 16 gage, or heavier, black annealed, steel wire.

### 2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
  - 1. Use one brand of cement throughout project unless otherwise acceptable to Architect.
- B. Fly Ash: ASTM C 618, Type F, except loss of ignition shall be less than 3% and all fly ash shall be a classified processed material.
- C. Normal Weight Aggregates: ASTM C 33 and as herein specified. Provide aggregates from a single source for exposed concrete.
  - 1. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
- D. Water: Drinkable.
- E. Admixtures, General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions. Concrete admixtures shall conform to the appropriate specification listed. Do not use admixtures which have not been incorporated and tested in the acceptable mixes unless otherwise authorized in writing by the Architect. Provide admixture manufacturer's written certification that chloride ion content complies with

specified requirements. Use of calcium chloride shall not be allowed.

- F. Air-Entraining Admixture: ASTM C 260, vensol resin type certified by manufacturer to be compatible with other required admixtures.
- G. Water-Reducing Admixture: ASTM C 494, Type A, containing no more chloride ions than in normal city drinking water.
- H. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G and contain nor more chloride ions than in normal city drinking water.
- I. Water-Reducing, non-chloride accelerating Admixture: ASTM C 494, Type E and containing nor more chloride ions than in normal city drinking water.
- J. Water-Reducing, Retarding Admixture: ASTM C 494, Type D and contain nor more chloride ions than in normal city drinking water.
- K. Certification: Provide admixture manufacturer's written certification that chloride ion content complies with specified requirements.

## 2.4 RELATED MATERIALS

- A. Reglets: Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217 inch thick (26-gage) galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.
- B. Building slab on grade subbase: Provide a clean compacted washed stone, 3/8" aggregate (min.), #78 stone. Place evenly and with level surface with a thickness as specified on drawings.
- C. Vapor Retarder: Provide vapor retarder cover over prepared base material where indicated below slabs on grade. Use only materials that are resistant to deterioration when tested in accordance with ASTM E 154, as follows:
  - 1. Water-resistant barrier consisting of heavy Kraft papers laminated together with glass-fiber reinforcement and overcoated with black polyethylene on each side.
    - a. Product: "Moistop," Fortifiber Corp.
    - b. Approved equal to previous.
- D. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as abrasive aggregate for nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, and nonglazing and is unaffected by freezing, moisture, and cleaning materials.
- E. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- F. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

- 1. Waterproof paper.
- 2. Polyethylene film.
- 3. Polyethylene-coated burlap.
- G. Bonding Compound: Polyvinyl acetate or acrylic base. Rewettable type.
- H. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.
- I. Chemical Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluorosilicates.
- J. Isolation Joints: Perimeter premolded expansion joint fillers shall be premolded asphalt impregnated type, conforming to ASTM C-994.
- K. Joint Sealant Material for construction joints and sawcut control joints is to be an approved two part self-leveling polyurethane sealant. Joint sealant is to be placed min. 90 days after construction of slab.

# 2.5 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301 and ACI 318. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. If field experience method is used, the standard deviation calculated from certified records shall be less than 600 psi or if no suitable records are available the laboratory trial method shall be used. Select proportions to provide an average over strength of 1200 psi. The testing facility shall not be the same as used for field quality control testing.
  - 1. Limit use of fly ash to not less than 15% nor more than 25 percent of cement content by weight.
  - 2. Fly ash shall not be permitted for air-entrained, weather exposed mixes.
- B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.
- C. Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:
  - 1. Weather Exposed Concrete 4000-psi, 28-day compressive strength; W/C ratio, 0.45 maximum. (air-entrained)
  - 2. All other concrete except as noted 3000-psi, 28-day compressive strength; W/C ratio, 0.58 maximum (non-air-entrained).
  - 3. Grout for masonry 3000-psi, 28-day compressive strength;
- D. The nominal maximum size of coarse aggregate shall be 3/4" except use 3/8" pea gravel

aggregate for masonry concrete grout.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

## 2.6 ADMIXTURES

- A. Use water-reducing admixture in concrete as required for placement and workability. Use high-range water-reducing admixture (Superplasticizer) in masonry wall concrete grout as required for placement and workability. Do not use in other concrete unless approved by Architect.
- B. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
- C. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within following limits:
  - 1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
    - a. Use 6.0 percent with 3/4-inch max. aggregate.
- D. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.
- E. Water-Cement Ratio: Provide concrete with maximum water-cement (W/C) ratios as specified in "Proportion and Design of Mixes" Section of this specification.
- F. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
  - 1. Ramps, slabs, and sloping surfaces: Not more than 3 inches.
  - 2. Concrete containing HRWR admixture (Superplasticizer): Not more than 8 inches after addition of HRWR to site-verified 2-inch to 3-inch slump concrete.
  - 3. Other concrete: Not less than 3", not more than 4"... Contractor is to reject concrete delivered to site with slump in excess of that specified.

# 2.7 CONCRETE MIXING

A. Concrete shall be mixed at batch plants or it may be transit mixed as specified herein. Concrete batch plants must comply with the requirements of ACI 304 with sufficient capacity to produce concrete of the quantity and quality as specified herein. All plant facilities are subject to inspection by the Architect or his Agent.

- B. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.
- C. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified. Water is to be added at the job site only if the slump will not exceed the specified limit, the design water/cement ration will not be exceeded, and the concrete supplier authorizes in writing the addition of water. Addition of water for purpose of retempering will not be permitted.
  - During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing and placing time than specified in ASTM C 94 is required. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 60 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 45 minutes.

## PART 3 - EXECUTION

### 3.1 GENERAL

A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

#### 3.2 FORMS

- A. General: Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.
- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
- D. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

- E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing before concrete placement as required to prevent mortar leaks and maintain proper alignment.

# 3.3 VAPOR RETARDER/BARRIER INSTALLATION

- A. General: Following leveling and vibration of washed stone base for slabs on grade, place vapor retarder/barrier sheeting with longest dimension parallel with direction of pour.
- B. Lap joints 6 inches and seal vapor barrier joints with manufacturers' recommended mastic and pressure-sensitive tape.

# 3.4 FABRICATION, HANDLING AND PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.
  - 1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect. Do not bend bars embedded in cured concrete. Set dowels and anchor bolts by means of plywood templates. No heat bending of reinforcing bars will be permitted.
- D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Maintain 3" rebar clearance for concrete poured against earth, 2" clearance for weather exposed concrete, 1-1/2" clearance for columns and 1" for other interior concrete unless noted otherwise.
- E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Fabrication of Reinforcement:

- 1. Reinforcing steel shall be fabricated to shapes and dimensions indicated on drawings, and in compliance with applicable provisions of ACI 315 and ACI 318.
- 2. Bars shall be bent cold in shop. No bars shall be bent in field unless specifically indicated on drawings.
- 3. Fabrication of reinforcing steel prior to review and approval of shop drawings by Architect shall be solely the responsibility of the Contractor.
- G. Splices of Reinforcement:
  - 1. Splices and offsets in reinforcements shall not be made at points of maximum stress.
  - 2. Splices shall be approved by Engineer. Splices shall provide sufficient lap to transfer required stress.
  - 3. Stagger splices of adjacent bars wherever possible.
- H. Fabricating and Placing Tolerances:
  - 1. Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:
  - 2. Sheared length: +/- 1"
  - 3. Overall dimensions of stirrups and ties: +/- 1/4".
  - 4. All other bends: +/- 1".
  - 5. Bars shall be placed to the following tolerances: +/- 1/4".
  - 6. Wire fabric shall be placed to the following tolerances: +/- 1/2" from indicated location.
  - 7. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits or embedded items. If the bars are moved more than one bar diameter or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to approval by the Architect.
- I. Handling Reinforcement: Reinforcing steel shall be delivered to the project site properly tagged, bundled and ready to place. Reinforcing steel delivered to the project site, and not immediately placed in forms, shall be protected from mud, rust producing conditions, oil, grease, or distortion. Reinforcing steel shall be stored off the ground on skids.
- J. Welding of reinforcing is not permitted unless specifically allowed by architect. When approved, welding is to be in accordance with AWS D1.4. No welding is to be done at the bend of a bar. The Architect shall always be notified of the concrete placing schedule in advance and in ample time prior to placement of concrete to observe inspect the reinforcement. Inspection of reinforcement will be made only after each section to be placed is complete. Such observations shall not relieve the Contractor of responsibility of complying with contract documents.

# 3.5 JOINTS

- A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.
- B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Accepted bulkheads designed for this purpose may be used

for slabs. See also drawing details.

- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated. Do not continue reinforcement through sides of strip placements.
- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
- F. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. See typical details for saw cut and all other control joint requirements.
  - 1. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
  - 2. If joint pattern not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
  - 3. Joint sealant material is specified in Division 7 Sections of these specifications. See also typical control joint details on drawings.

## 3.6 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.
- B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

# 3.7 PREPARATION OF FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before reinforcement is placed.
- B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.
- D. Clean re-used forms of concrete matrix residue, repair and patch as required to return to

acceptable surface condition.

### 3.8 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work.
  - 1. Moisten wood forms immediately before placing concrete where form coatings are not used. Moisten dry subgrade materials.
  - 2. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
- B. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.
- C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
  - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
  - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- E. Refer to "General Notes" on drawings, for placement requirements, for concrete masonry unit fill.
- F. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
  - 1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not sprinkle water on the plastic concrete surface. Do not disturb slab surfaces prior to beginning finishing operations.
  - 3. Maintain reinforcing in proper position during concrete placement.
- G. Cold-Weather Placing: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- H. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
  - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 2. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
  - 3. Provide enclosures around areas to be poured and provide uniform space heating to maintain a temperature of not less than 60 degrees F (heaters which exhaust gases that contain carbons are not allowed). This temperature is to be maintained for not less than 7 days. In less severe cold temperatures, covering concrete with insulating blankets will be an acceptable alternative to providing heated enclosures.
- I. Hot-Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified. Concrete with temperature in excess of 90 degrees F is not to be placed.
  - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
  - 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
  - 3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
  - 4. Use water-reducing retarding admixture, Type D, when required by high temperatures, low humidity, or other adverse placing conditions, when acceptable to Architect.

#### 3.9 FINISH OF FORMED SURFACES

- A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with the holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and

smoothed.

- C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment, not later than one day after form removal.
  - 1. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

#### 3.10MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.
- B. After placing slabs, plane surface to tolerances for floor flatness (Ff) of 15 and floor levelness (Fl) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
- C. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified; or portland cement terrazzo; and as otherwise indicated.
  - 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of Ff 18 Fl 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- D. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, or other thin film finish coating system.
  - After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20 - Fl 17. Grind smooth surface defects that would telegraph through applied floor covering system.
- E. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly

scarifying surface by fine brooming.

- F. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
  - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- G. Chemical Hardener Finish: Apply chemical-hardener finish to exposed interior concrete floors. Apply liquid chemical-hardener liquid hardener with water (parts of hardener/water as follows), and apply in 3 coats; first coat, 1/3-strength; second coat, 1/2-strength; third coat, 2/3-strength. Evenly apply each coat, and allow 24 hours for drying between coats.
  - 1. Apply proprietary chemical hardeners in accordance with manufacturer's printed instructions.
  - 2. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.
- H. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere as indicated.
- I. After completion of float finishing and before starting trowel finish, uniformly spread 25 lbs. of dampened nonslip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.
- J. After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose nonslip aggregate.

#### 3.11CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days in accordance with ACI 308 procedures. Avoid rapid drying at end of final curing period.
- C. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified. If temperatures are low and moisture curing is not practical, use polyethylene film in lieu of specified moisture curing.
- D. Provide moisture curing by following methods.
  - 1. Keep concrete surface continuously wet by covering with water.
  - 2. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.
- E. Provide moisture-cover curing as follows:

- 1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- F. Curing Formed Surfaces: Cure formed concrete surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- G. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces, by use of moisture-retaining cover, unless otherwise directed.
- H. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

#### 3.12SHORES AND SUPPORTS

A. General: Contractor is to provide all temporary shores and supports as required.

#### 3.13REMOVAL OF FORMS

A. General: Formwork not supporting weight of concrete, such as walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

#### 3.14 REUSE OF FORMS

- A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces except as acceptable to Architect.

#### 3.15MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. All anchor bolts and reinforcing dowels are to be secured into position by templates and template supports prior to placing any concrete.

- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
- D. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.
- E. Reinforced Masonry: Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

#### 3.16CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.
  - Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried. Patching mortar is to be same strength as concrete being repaired.
  - 2. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry-pack mortar, or precast cement cone plugs secured in place with bonding agent.
  - 1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- C. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.
  - 1. Repair finished unformed surfaces that contain defects that affect durability of concrete. Surface defects, as such, include crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
  - 2. Correct high areas in unformed surfaces by grinding after concrete has cured at

least 14 days.

- 3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
- D. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.
- E. Repair methods not specified above may be used, subject to acceptance of Architect.

## 3.17QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. General: The Contractor will employ a testing laboratory to perform tests and to submit test reports.
- B. Sampling and testing for quality control during placement of concrete may include the following, as directed by Architect.
- C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
  - 1. Slump: ASTM C 143; one test at point of discharge for each compressive strength test of each type of concrete; additional tests when concrete consistency seems to have changed.
  - 2. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each compressive strength test of each type of air-entrained concrete.
  - 3. Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and each time a set of compression test specimens is made.
  - 4. Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.
  - 5. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yds. plus additional sets for each 50 cu. yds. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
  - 6. When frequency of testing will provide fewer than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
  - 7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
  - 8. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
- D. Test results will be reported in writing to Architect, Structural Engineer, Ready-Mix

Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests, time batched and placed, air temperature, concrete temperature, slump, air content, and results of other specified testing. The use of a laboratory will in no way relieve the Contractor from providing specified materials.

- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- F. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.
- G. Contractor is to make a slump test for each truck, not lab tested. Contractor is to check temperature of each truck, not lab tested, when the ambient temperature is less than 40 degrees F. or greater than 80 degrees F.

END OF SECTION 03300

# 03/2016

## Section 04700 – MANUFACTURED STONE

## Part 1—General

## 1.01.1 Summary

- A. Section Includes: Manufactured stone veneer, Manufactured stone trim and application materials.
- B. Related Sections:
  - 1. Division 07, Section specifying water resistive barrier over framed walls.
  - 2. Division 07 Section specifying flashing materials.

## 1.02 References

- A. American Concrete Institute (ACI).
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTMC 39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
  - 2. AST M C 67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
  - 3. AST M C 177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
  - 4. AST M C 192, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
  - 5. AST M C 270, Standard Specification for Mortar for Unit Masonry.
  - 6. AST M C 482, Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.
  - 7. AST M D 226, Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
  - 8. AST M E 2556/ E 2556M Standard Specification for Vapor Permeable Flexible Sheet Water Resistive Barriers Intended for Mechanical Attachment.
- B. Building Materials Evaluation Commission.
- D. International Code Council (ICC):
  - 1. ES Report.
  - 2. U BC Standard No. 14-1, Kraft Waterproof Building Paper.
- E. Masonry Standards Joint Committee (MSJC) of The Masonry Society.
- F. Texas Department of Insurance Product Evaluation.
- G. Underwriters Laboratories (UL):
  - 1. Classification File Number.

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- 2. U L 723, Standard for Safety for Surface Burning Characteristics of Building Materials.
- H. US Department of Housing and Urban Development (HUD): Material Release Number.

## 1.02.1 Submittals

- A. Reference Section 01 33 00–Submittal Procedures; submit following items:
  - 1. Product Data: Manufactured masonry and application materials including mortar color charts, and water resistive barrier.
  - 2. Samples: Panel containing full-size samples of specified manufactured masonry showing full range of colors and textures complete with specified mortar.
  - a. Actual size of masonry sample approximately 12 by 12 inches (300 by 300 mm).
  - 3. Quality Assurance/Control Submittals:
    - a. Qualifications:
      - 1) Proof of manufacturer qualifications.
      - 2) Proof of installer qualifications.
    - b. Certificates: ICC-ES Report.
    - c. Test Reports for physical properties.
    - d. Manufacturer's Installation Instructions.
- B. Closeout Submittals: Reference Section 01 78 00–Closeout Submittals; submit following items.
  - 1. Maintenance Instructions.
  - 2. Special Warranties.

#### 1.03 Quality Assurance

- A. Qualificaions
  - 1. Manufacturer Qualifications:
    - a. Minimum five years experience in producing manufactured masonry.
    - b. Member of following organizations:
      - 1) MSJC.
      - 2) ACI.
      - 3) ASTM.
  - 2. Installer Qualifications: Company with documented experience in installation of manufactured masonry including minimum 5 projects within 400 mile radius of this Project.
  - B. Certifications:
    - 1. Current ICC-ES Report.
    - 2. U L: Classification File Number.
    - 3. Building Materials Evaluation Commission.
    - 4. HUD: Material Release Number.
    - 5. Texas Department of Insurance Product Evaluation.
    - 6. Florida Product Approval Number.
  - B. Field Samples: Provide in a location selected by Architect showing representative sample of installed product including penetration and termination details and mortar color and tooling.

- 1. Reference Section 01 45 00 Quality Control.
- 2. Minimum Size: [4 by 4 feet.
- 3. Approved field samples may remain as part of completed Work.

#### 1.04 Delivery, Storage, and Handling

- A. Reference Section 01 66 00–Product Storage and Handling Requirements.
- B. Follow manufacturer's instructions.
- C. Store moisture-sensitive materials in weather protected enclosures.

## 1.05 Project/SITE Conditions

A. Environmental Requirements: Maintain materials and ambient temperature in area of installation at minimum 40 degrees F (4 degrees C) prior to, during, and for 48 hours following installation.

#### 1.07 Warranty

A. Special Warranty: Provide manufacturer's standard limited warranty against defects in manufacturing for a period of 50 years following date of Final Acceptance.

#### 1.08 Maintenance

A. Extra Materials: Furnish extra manufactured stone material in a variety of shapes and sizes in quantity equal to three percent of the installed stone.

# Part 2—Products

## 2.01 Manufacturer

A. Boral Stone Products LLC T el: (800) 255-1727
 2256 Centennial Road Fax: (866) 552-9022 Toledo, OH 43617 Website: www.culturedstone.com
 1. Manufacturer's Distributor:

Piedmont Stone, Inc. 3005 US 220 BUS Stoneville, NC 27048 Telephone: 336-573-3040

C. Substitutions: None permitted.

#### 2.02 Manufactured masonry Materials

A. Cultured Stone® Textures:

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Select from either Cobblefield or Limestone

#### www.culturedstone.com

B. Architectural Trim:

Provide all sills, trim, corners, caps as required to match wall color and texture. Trim selections shall be approved by the Architect.

- C. Manufactured Masonry Physical Properties:
  - 1. Compressive Strength: ASTM C 192 and ASTM C 39, 1800 psi (12.4 MPa)
  - 2. Bond Between Stone Unit, Type S Mortar, and Backing: ASTM C 482, 50 psi (345 kPa).
  - Thermal Resistance: ASTM C 177, R-factor, 0.355 per inch (25.4 mm) of thickness.
    Freeze/Thaw: ASTM C 67, 50 cycles, no disintegration and less than 3 percent weight loss.
  - 5. Fire Hazard Test, UL 723:
    - a. Flame spread: 0.
    - b. Smoke Development: 0.
  - 6. Maximum Veneer Unit Weight: 15 psf (73 kg/m<sub>2</sub>).

#### 2.03 Related Materials

- A. Water Resistive Barrier: Vapor permeable flexible sheet water resistive barriers comply with ASTM E 2556/ E 2556M]
- B. Metal Lath: 2.5 lb (1.4 kg/m<sub>2</sub>) galvanized expanded metal lath or 18 (1.3 mm) gauge woven wire mesh 3.4 lb (1.8 kg/m<sub>2</sub>) galvanized expanded rib lath.
- C. Fasteners:
  - 1. Into Metal Studs: Minimum 7/16 inch (11.1 mm) head diameter, corrosion-resistant self-drilling, self tapping, pancake head screws of sufficient length to penetrate 3/8 inch (10 mm) minimum into the stud.
- D. Mortar: Premixed Type N, Type S or mortar mixed using components and proportions following manufactured masonry manufacturer's installation instructions. Comply with ASTM C 270.
  - 1. Mortar Color: Iron oxide pigments.
- E. Weep screed as required for installation over framed construction.

#### Part 3—Execution

#### 3.01 Examination

- A. Examine substrates upon which manufactured masonry will be installed.
- B. Coordinate with responsible entity to correct unsatisfactory conditions.
- C. Commencement of work by installer is acceptance of substrate conditions.

#### 3.02 Preparation

- A. Protection: Prevent work from occurring on the opposite of walls to which manufactured masonry is applied during and for 48 hours following installation of the manufactured masonry.
- B. Surface Preparation: Follow manufacturer's instructions designated below for the appropriate type of manufactured masonry and substrate.

## 3.03 INSTALLATION

- A. Install Cultured Stone® products in accordance with manufacturer's Cultured Stone® installation instructions using [grouted] [tight fit] joints.
- B. Install architectural trim products in accordance with manufacturer's Cultured Stone® installation instructions.
- D. Install/Apply Related Materials specified above in accordance with type of substrate and manufactured masonry manufacturer's installation instructions.

## 3.045 Cleaning

- A. Reference Section 01 74 00–Cleaning and Waste Management.
- B. Clean manufactured masonry in accordance with manufacturer's installation instructions.

#### 3.06 Protection

- A. Protect finished work from rain during and for 48 hours following installation.
- B. Protect finished work from damage during remainder of construction period.

## **End of Section**

# SECTION 04810 - UNIT MASONRY

## PART 1 - GENERAL

#### **1.1 RELATED DOCUMENTS**

A. Drawings and general provisions of 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. Concrete unit masonry.
- B. Related Sections: The following sections contain requirements that relate to this Section:
  - 1. Division 7 Section "Flashing and Sheet Metal" for exposed sheet metal flashing installed in masonry.
- C. Products installed but not furnished under this Section include the following:
  - 1. Steel lintels in unit masonry are specified in Division 5 Section "Metal Fabrications."
  - 2. Wood nailers and blocking built into unit masonry are specified in Division 6 Section "Miscellaneous Carpentry."
  - 3. Reglets in masonry joints for metal flashing are specified in Division 7 Section "Flashing and Sheet Metal."
  - 4. Hollow metal frames in unit masonry openings are specified in Division 8 Section "Steel Doors and Frames."
  - 5. Openings for mechanical equipment and sleeves.

#### 1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following installed compressive strengths (f'm):
  - 1. For concrete unit masonry: As follows:
    - a. f'm = 1500 psi.

## **1.4 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each different masonry unit, accessory, and other manufactured product indicated.
- C. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcing" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.
- D. Samples for initial selection purposes of the following:
  - 1. Unit masonry samples in small-scale form showing full extent of colors and textures available for each different exposed masonry unit required.
  - 2. Colored masonry mortar samples showing full extent of colors available.
- E. Samples for verification purposes of the following:
  - 1. Full-size units for each different exposed masonry unit required showing full range of exposed color, texture, and dimensions to be expected in completed construction.
    - a. Include size variation data verifying that actual range of sizes for brick falls within ASTM C 216 dimension tolerances for brick where modular dimensioning is indicated.
  - 2. Vinyl weep holes/vents painted in color to match mortar color.
  - 3. Accessories embedded in the masonry.
- F. Material certificates for the following signed by manufacturer and Contractor certifying that each material complies with requirements.
  - 1. Each different cement product required for mortar and grout including name of manufacturer, brand, type, and weight slips at time of delivery.
  - 2. Each material and grade indicated for reinforcing bars.
  - 3. Each type and size of joint reinforcement.
  - 4. Each type and size of anchors, ties, and metal accessories.
- G. Material test reports from a qualified independent testing laboratory employed and paid by Contractor indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:
  - 1. Mortar complying with property requirements of ASTM C 270.
  - 2. Grout mixes. Include description of type and proportions of grout ingredients.

- 3. Masonry units.
- H. Cold-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.
- I. Hot-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.
- J. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, telephone numbers, names of Architects and Owners, and other information specified.
- K. Results from tests and inspections performed by Owner's representatives will be reported promptly and in writing to Architect and Contractor.

# 1.5 QUALITY ASSURANCE

- A. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6 "Specifications for Masonry Structures," except as otherwise indicated.
  - 1. Revise ACI 530.1/ASCE 6 to exclude Sections 1.4 and 1.7; Parts 2.1.2, 3.1.2, and 4.1.2; and Articles 1.5.1.2, 1.5.1.3, 2.1.1.1, 2.1.1.2, and 2.3.3.9 and to modify Article 2.1.1.4 by deleting requirement for installing vent pipes and conduits built into masonry.
- B. Inspecting Laboratory Qualifications: To qualify for employment in performing tests and inspection specified in this Section, an independent testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM C 1093, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying the progress of the Work.
- C. Fire Performance Characteristics: Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E 119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.
- D. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.
- E. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each

aggregate.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.
- C. Store cementitious materials off the ground, under cover, and in dry location.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

## 1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
  - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
  - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings.
- D. Cold-Weather Construction: Comply with referenced unit masonry standard for cold-weather construction and the following:

- 1. Do not lay masonry units that are wet or frozen.
- 2. Remove masonry damaged by freezing conditions.
- E. Hot-Weather Construction: Comply with referenced unit masonry standard.

# PART 2 - PRODUCTS

# 2.1 MATERIALS, GENERAL

# 2.2 CONCRETE MASONRY UNITS

- A. General: Comply with requirements indicated below applicable to each form of concrete masonry unit required.
  Workmanship shall be in accordance with Brick Institute of America, Section 7B.
  - 1. Provide special shapes where indicated and as follows:
    - a. For lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
  - 2. Size: Provide concrete masonry units complying with requirements indicated below for size that are manufactured to specified face dimensions within tolerances specified in the applicable referenced ASTM specification for concrete masonry units.
    - a. Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated on drawings.
    - b. Concrete Building Brick: Specified dimensions as follows:
      - 1) Standard Modular: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
    - c. Prefaced Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated on drawings, with prefaced surfaces having 1/16-inch-thick returns of facing to create 1/4-inch-wide mortar joints with modular coursing.
  - 3. Provide Type II, non-moisture-controlled units.
  - 4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
- B. Hollow Load-Bearing Concrete Masonry Units: ASTM C 90, Grade N and as follows:
  - 1. Unit Compressive Strength: Provide units with minimum average net

area compressive strength indicated below:

- a. 1900 psi.
- 2. Weight Classification: Lightweight.
- C. Solid Load-Bearing Concrete Masonry Units: ASTM C 145, Grade N and as follows:
  - 1. Unit Compressive Strength: Provide units with minimum average net area compressive strength indicated below:
    - a. 1800 psi.
  - 2. Weight Classification: Lightweight.
- D. Concrete Building Brick: ASTM C 55 and as follows:
  - 1. Unit Compressive Strength: Provide units with minimum average net area compressive strength indicated below:
    - a. 3500 psi.
  - 2. Weight Classification: Lightweight.
- 2.4 MORTAR AND GROUT MATERIALS
  - A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce required mortar color.
  - B Masonry Cement: ASTM C 91.
  - C. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this article, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.
  - D. Hydrated Lime: ASTM C 207, Type S.
  - E. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.
  - F. Aggregate for Grout: ASTM C 404.
  - G. Water: Clean and potable.

# 2.5 REINFORCING STEEL

- A. General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article.
- B. Steel Reinforcing Bars: Material and grade as follows:
  - 1. Billet steel complying with ASTM A 615.
  - 2. Grade 60.
- C. Deformed Reinforcing Wire: ASTM A 496.
- D. Plain Welded Wire Fabric: ASTM A 185.
- E. Deformed Welded Wire Fabric: ASTM A 497.

# 2.6 JOINT REINFORCEMENT

- A. General: Provide joint reinforcement complying with requirements of referenced unit masonry standard and this article, formed from the following:
  - 1. Galvanized carbon steel wire, coating class as required by referenced unit masonry standard for application indicated. Hot dip for exterior walls and walls in contact with earth. 1.5 oz. per SF of wire surface. Hot dip after fabrication of units.
- B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements indicated below:
  - 1. Wire Diameter for Side Rods: 0.1875 inch.
  - 2. Wire Diameter for Cross Rods: 0.1483 inch (9 gage).
  - 3. For single-wythe masonry provide type as follows with single pair of side rods:
    - a. Truss design with continuous diagonal cross rods spaced not more than 16 inches o.c.
  - 4. For multiwythe masonry provide type as follows:
    - a Truss design with diagonal cross rods spaced not more than 16 inches o.c. and number of side rods as follows:
      - Number of Side Rods for Multiwythe Concrete Masonry: One side rod for each face shell of hollow masonry units more than 4 inches in nominal width plus one side rod for each wythe of

masonry 4 inches or less in nominal width.

- b. Tab design with single pair of side rods and rectangular box-type cross ties spaced not more than 16 inches o.c.; with side rods spaced for embedment within each face shell of backup wythe and ties extended to engage the outer wythe by at least 1-1/2 inches. Provide tabs with drip bend for cavity wall reinforcing.
- c. Use units with adjustable 2-piece rectangular ties where horizontal joints of facing wythe do not align with those of backup by more than and where indicated.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering joint reinforcement that may be incorporated in the Work include, but are not limited to, the following:
  - 1. AA Wire Products Co.
  - 2. Dur-O-Wal, Inc.
  - 3. Heckman Building Products, Inc.
  - 4. Hohmann & Barnard, Inc.
  - 5. Masonry Reinforcing Corp. of America.
  - 6. National Wire Products Industries.
  - 7. Southern Construction Products, Inc.
- 2.7 TIES AND ANCHORS, GENERAL
  - A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of referenced unit masonry standard and of this article.
  - B. Galvanized Carbon Steel Wire: ASTM A 82, coating class as required by referenced unit masonry standard, for wire ties and anchors in interior walls, unless otherwise indicated.
    - 1. Wire Diameter: 0.1875 inch.
  - C. Galvanized Steel Sheet: As follows:
    - 1. ASTM A 526 (commercial quality), Coating Designation G60, steel sheet zinc-coated by hot-dip process on continuous lines prior to fabrication, for sheet metal ties and anchors completely embedded in mortar.
    - 2. Galvanized Steel Sheet Thickness: For steel sheet hot-dip galvanized by continuous process prior to fabrication:
      - a. 0.0635 inch (16 gage).

- D. Galvanized Heavy-Thickness Steel Sheet: ASTM A 635 (commercial quality) hot-rolled carbon steel sheet hot-dip galvanized after fabrication to comply with ASTM A 525, Class B3, for rigid anchors fabricated from steel sheet or strip with a thickness of 0.180 inch and greater.
- E. Steel Plates and Bars: ASTM A 36, shop painted with 2 coats of coal-tar epoxy-polyamide paint complying with SSPC Paint-16 to comply with SSPC-PA1 ("Paint Application Specification No. 1") and SSPC-SP6 ("Commercial Blast Cleaning") for surface preparation.
- F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. AA Wire Products Co.
  - 2. Dur-O-Wal, Inc.
  - 3. Heckman Building Products, Inc.
  - 4. Hohmann & Barnard, Inc.
  - 5. Masonry Reinforcing Corp. of America.
  - 6. National Wire Products Industries.
  - 7. Southern Construction Products, Inc.

# 2.8 BENT WIRE TIES

- A. Individual units prefabricated from bent wire to comply with requirements indicated below:
- B. Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with closed ends and not less than 4 inches wide.
- C. Tie Shape for Solid Masonry Unit Construction: Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long.
- D. Type for Masonry Where Coursing Between Wythes Align: Unit ties bent from one piece of wire.
- E. Type for Masonry Where Coursing Between Wythes Does Not Align: Adjustable ties composed of two parts, one with pintles, the other with eyes, maximum misalignment 1-1/4 inches.

# 2.9 ADJUSTABLE ANCHORS FOR CONNECTING MASONRY TO STRUCTURAL FRAMEWORK

A. General: Two-piece assemblies as described below allowing vertical or horizontal differential movement between wall and framework parallel to plane of wall, but resisting tension and compression forces perpendicular to it.

- B. For anchorage to concrete framework, provide manufacturer's standard with dovetail anchor section formed from sheet metal and triangular-shaped wire tie section sized to extend within 1 inch of masonry face and as follows:
- C. For anchorage to steel framework provide manufacturer's standard anchors with crimped 1/4-inch-diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1 inch of masonry face and as follows:
  - 1. Wire Diameter: 0.1875 inch.

#### 2.10 RIGID ANCHORS

- A. Provide straps of form and length indicated, fabricated from metal strips of following width and thickness.
  - 1. 1-1/2 inches wide by 1/4 inch thick.
- 2.11 ADJUSTABLE MASONRY VENEER ANCHORS
  - A. General: Provide two-piece assemblies allowing vertical or horizontal differential movement between wall and framework parallel to plane of wall, but resisting tension and compression forces perpendicular to it; for attachment over sheathing to metal studs; and with the following structural performance characteristics:
    - 1. Structural Performance Characteristics: Capable of withstanding a 100 lbf load in either tension or compression without deforming over, or developing play in excess of, 0.05 inch.
- 2.12 MISCELLANEOUS ANCHORS
  - A. Unit Type Masonry Inserts in Concrete: Cast iron or malleable iron inserts of type and size indicated.
  - C. Anchor Bolts: Steel bolts complying with A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
    - 1. Headed bolts.
    - 2. Nonheaded bolts, bent in manner indicated.
- 2.13 POSTINSTALLED ANCHORS
  - A. Anchors as described below, with capability to sustain, without failure, load

imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing laboratory.

- 1. Type: Chemical anchors.
- 2. Type: Expansion anchors.
- 3. Corrosion Protection: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
- 4. For cast-in-place and postinstalled anchors in concrete: Capability to sustain, without failure, a load equal to 4 times loads imposed by masonry.
- 5. For postinstalled anchors in grouted concrete masonry units: Capability to sustain, without failure, a load equal to 6 times loads imposed by masonry.

## 2.14 EMBEDDED FLASHING MATERIALS

- A. Sheet Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section "Flashing and Sheet Metal" and below:
  - 1. Stainless Steel: 0.0156 inch (28 gage) thick.
- B. Vinyl Sheet Flashing: Flexible sheet flashings especially formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed masonry applications, black in color and of thickness indicated below:
  - 1. Thickness: 56 mils.
  - 2. Application: Use where flashing is fully concealed in masonry.
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 section "Flashing and Sheet Metal."
- D. Adhesive for Flashings: Of type recommended by manufacturer of flashing material for use indicated.
- E. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Metal Flashing:
    - a. "Cheney Flashing (Sawtooth)," Cheney Flashing Company, Inc.
    - b. "Keystone Three-Way Interlocking Thruwall Flashing," Keystone Flashing Co.
  - 2. Vinyl Sheet Flashing:

- a. "Lexsuco Water Barrier," International Permalite Inc.
- b. "Nervastral," Nervastral, Inc.

# 2.15 MISCELLANEOUS MASONRY ACCESSORIES

- A. Preformed Control Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
  - 1. Styrene-Butadiene Rubber Compound: ASTM D 2000, Designation 2AA-805.
- B. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- 2.17 MASONRY CLEANERS
  - A. Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2-cup dry measure) and laundry detergent (1/2-cup dry measure) dissolved in one gallon of water.
  - B. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned:.
    - 1. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.
    - 2. For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.
    - 3. Available Products: Subject to compliance with requirements, a product that may be used to clean unit masonry surfaces includes, but is not limited to, the following:
      - a. "Sure Klean No. 600 Detergent," ProSoCo, Inc.
      - b. "Sure Klean No. 101 Lime Solvent," ProSoCo., Inc.
      - c. "Sure Klean Vana Trol," ProSoCo, Inc.

# 2.18 MORTAR AND GROUT MIXES

A. General: Do not add admixtures including coloring 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.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification for job-mixed mortar and ASTM C 1142 for ready-mixed mortar, of types indicated below:
  - 1. For masonry below grade and in contact with earth, and where indicated, use type indicated below:
    - a. Type S.
  - 2. For reinforced masonry and where indicated, use type indicated below:
    - a. Type S.
  - 3. For exterior, above-grade loadbearing and nonloadbearing walls and parapet walls; for interior loadbearing walls; for interior nonloadbearing partitions, and for other applications where another type is not indicated, use type indicated below:
    - a. Type S.
- C. Grout for Unit Masonry: Comply with ASTM C 476 and referenced unit masonry standard.

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry.
  - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry.
- B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with referenced unit masonry standard and other requirements

indicated applicable to each type of installation included in Project.

- B. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.
- C. Build chases and recesses as shown or required to accommodate items specified in this and other Sections of the Specifications. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.
- D. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.
- E. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

## 3.3 CONSTRUCTION TOLERANCES

A. Comply with construction tolerances of referenced unit masonry standard.

## 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.
- B. Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction. Section 7B of Brick Institute of America will be used as a standard of acceptable workmanship. Cavities shall be kept clean and <u>all</u> bed and head joints <u>must</u> be filled as units are placed slushing of head joints will not be accepted. The prope head joint is to be buttered 4 ways prior to placing for proper weather joint. Mortar is not to be cut off in cavity, spread excess mortar on back side of wythe(s).
- C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less that nominal 4-inch horizontal face dimensions at corners or jambs.
  - 1. Running bond with vertical joint in each course centered on units in courses above and below. Match existing.
- D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe

at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

- E. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.
- F. Built-In Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
  - 1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
  - 2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
  - 3. Fill cores in hollow concrete masonry units with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

# 3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
  - 1. With full mortar coverage on horizontal and vertical face shells.
  - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
  - 3. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- B. Cut joints flush for masonry walls to be concealed or to be covered by other materials, unless otherwise indicated.

# 3.6 STRUCTURAL BONDING OF MULTIWYTHE MASONRY

- A. Use individual metal ties installed in horizontal joints to bond wythes together.
- B. Use continuous horizontal joint reinforcement installed in horizontal mortar joints for bond tie between wythes.
- C. Use either of the structural bonding systems specified above.
- D. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

- 1. Provide continuity with horizontal joint reinforcement at corners using prefabricated "L" units, in addition to masonry bonding.
- E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:
  - 1. Provide continuity with horizontal joint reinforcement using prefabricated "T" units.

# 3.7 CAVITIES/AIR SPACES

- A. Keep cavities/air spaces clean of mortar droppings and other materials during construction. Strike joints facing cavities/air spaces flush.
- B. Tie exterior wythe to backup with continuous horizontal joint reinforcing.
- C. Install vents in vertical head joints at the top of each continuous cavity/air space. Space vents and close off cavities/air spaces vertically and horizontally with blocking in manner indicated.

#### 3.9 HORIZONTAL JOINT REINFORCEMENT

- A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing a minimum of 6 inches.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

# 3.10 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
  - 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
  - 2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

# 3.11 MOVEMENT (CONTROL AND EXPANSION) JOINTS

- A. General: Install control and expansion joints in unit masonry where indicated. Build in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry as follows:
  - 1. Fit bond breaker strips into hollow contour in ends of block units on one side of control joint. Fill the resultant core with grout and rake joints in exposed faces.
  - 2. Install preformed control joint gaskets designed to fit standard sash block.
  - 3. Install special shapes designed for control joints. Install bond breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
  - 4. Space at 25'-0" maximum.
- C. Form expansion joints in brick made from clay or shale as follows:
  - 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints, if any.
  - 2. Build flanges of factory-fabricated expansion joint units into masonry.
  - 3. Build in joint fillers where indicated.
  - 4. Form open joint of width indicated but not less than 3/8 inch for installation of sealant and backer rod specified in Division 7 Section "Joint Sealers." Maintain joint free and clear of mortar.
- D. Install flashings as follows:
  - 1. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches, and through the inner wythe to within 1/2 inches of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2 inches, unless otherwise indicated.
  - 2. At heads and sills, extend flashing as specified above unless otherwise indicated but turn up ends not less than 2 inches to form a pan.
  - 3. Install flashing in masonry veneer walls as specified above but carry flashing up face of sheathing at least 8 inches and behind air infiltration barrier/building paper.

- 4. Interlock end joints of ribbed sheet metal flashings by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer and seal lap with elastomeric sealant complying with requirements of Division 7 Section "Joint Sealers" for application indicated.
- 5. Turn down sheet metal flashings at exterior face of masonry to form drip.
- 6. Cut off flashing flush with face of wall after masonry wall construction is completed.

# 3.13 INSTALLATION OF REINFORCED UNIT MASONRY

- A. General: Install reinforced unit masonry to comply with requirements of referenced unit masonry standard.
- B. Temporary Formwork: Construct formwork and shores to support reinforced masonry elements during construction.
  - 1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
- C. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
- D. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

# 3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.
- C. Final Cleaning: After mortar is thoroughly set and cured, at least thirty days but not more than ninety days, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning

before proceeding with cleaning of masonry.

- 3. Protect adjacent non masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
- 4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
- 5. Clean brick by means of bucket and brush hand-cleaning method described in BIA "Technical Note No. 20 Revised" using the following masonry cleaner:
- a. Job-mixed detergent solution.
  - b. Job-mixed acidic solution.
  - c. Proprietary acidic cleaner; apply in compliance with directions of acidic cleaner manufacturer.
  - 6. Clean concrete masonry by means of cleaning method indicated in NCMA TEK 45 applicable to type of stain present on exposed surfaces.
  - D. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

END OF SECTION 04810

# SECTION 05500 - METAL FABRICATIONS

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This section includes the following metal fabrications:
  - 1. Rough hardware.
  - 2. Loose bearing and leveling plates.
  - 3. Loose steel lintels.
  - 4. Miscellaneous framing and supports for the following:
    - a. Applications where framing and supports are not specified in other sections.
  - 5. Miscellaneous steel trim.
  - 6. Shelf and relieving angles.
  - 7. Steel pipe railings.
  - 8. Pipe bollards.
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 5 Section "Structural Steel" for structural steel framing system components.

#### 1.3 DEFINITIONS

A. Definitions in ASTM E 985 for railing-related terms apply to this section.

#### 1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance: Design, engineer, fabricate, and install the following metal fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each metal fabrication.

## 1.5 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for products used in miscellaneous metal fabrications, including paint

products and grout.

- C. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.
  - 1. Where installed metal fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for their preparation.
- D. Samples representative of materials and finished products as may be requested by Architect.
- E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

#### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Installer Qualifications: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.
- C. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel," D1.3 "Structural Welding Code - Sheet Steel", and D1.2 "Structural Welding Code - Aluminum."
  - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- D. Engineer Qualifications: Professional engineer licensed to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of metal fabrications similar in material, design, and extent to that indicated for this Project.

#### 1.7 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

#### 2.1 FERROUS METALS

- A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
- B. Wide Flange Shapes: ASTM A992.
- C Steel Plates, Channels, Angles, and Bars: ASTM A 36.
- D Rolled Steel Floor Plates: ASTM A 786.
- E. Steel Bars for Gratings: ASTM A 569 or ASTM A 36.
- F. Wire Rod for Grating Cross Bars: ASTM A 510.
- G. Steel Tubing: Product type (manufacturing method) and as follows:
  - 1. Cold-Formed Steel Tubing: ASTM A 500, grade as indicated below:
    - a. Grade A, unless otherwise indicated or required for design loading.
- H. Uncoated Structural Steel Sheet: Product type (manufacturing method), quality, and grade, as follows:
  - 1. Cold-Rolled Structural Steel Sheet: ASTM A 611, grade as follows:
    - a. Grade A, unless otherwise indicated or required by design loading.
- I. Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:
  - 1. Cold-Rolled Steel Sheet: ASTM A 366.
- J. Galvanized Steel Sheet: Quality as follows:
  - 1. Commercial Quality: ASTM A 526, G90 coating designation unless otherwise indicated.
- K. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:
  - 1. Black finish, unless otherwise indicated.
  - 2. Type S, Grade A, standard weight (schedule 40), unless otherwise indicated, or another grade or weight or both required by structural loads.
- L. Gray Iron Castings: ASTM A 48, Class 30.
- M. Malleable Iron Castings: ASTM A 47, grade 32510.

- N. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
- O. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.
- P. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

#### 2.2 GROUT AND ANCHORING CEMENT

- A. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD- C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.
- B. Erosion-Resistant Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include but are not limited to the following:
  - 1. Nonshrink Nonmetallic Grouts:
    - a. "Bonsal Construction Grout"; W. R. Bonsal Co.
    - b. "Diamond-Crete Grout"; Concrete Service Materials Co.
    - c. "Euco N-S Grout"; Euclid Chemical Co.
    - d. "Kemset"; Chem-Masters Corp.
    - e. "Crystex"; L & M Construction Chemicals, Inc.
    - f. "Masterflow 713"; Master Builders.
    - g. "Sealtight 588 Grout"; W. R. Meadows, Inc.
    - h. "Sonogrout"; Sonneborn Building Products Div., Rexnord Chemical Products, Inc.
    - i. "Stoncrete NM1"; Stonhard, Inc.
    - j. "Five Star Grout"; U. S. Grout Corp.
    - k. "Vibropruf #11"; Lambert Corp.
  - 2. Erosion-Resistant Anchoring Cement:
    - a. "Super Por-Rok"; Minwax Construction Products Division.

#### 2.3 FASTENERS

- A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon head type, ASTM A 32S

- C. Lag Bolts: Square head type, FS FF-B-561.
- D. Machine Screws: Cadmium plated steel, FS FF-S-92.
- E. Wood Screws: Flat head carbon steel, FS FF-S-111.
- F. Plain Washers: Round, carbon steel, FS FF-W-92.
- G. Drilled-In Expansion Anchors: Expansion anchors complying with FS FF-S-325, Group VIII (anchors, expansion, [nondrilling]), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade 5.
- H. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.
- I. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

#### 2.4 PAINT

- A. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.
- B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint-20.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.
- D. Zinc Chromate Primer: FS TT-P-645.

#### 2.5 FABRICATION, GENERAL

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
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- 1. Temperature Change (Range): 100 deg F (55.5 deg C).
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Remove sharp or rough areas on exposed traffic surfaces.
- G. Weld corners and seams continuously to comply with AWS recommendations and 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 that no roughness shows after finishing and contour of welded surface matches those adjacent.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. 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.
- K. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.
- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

#### 2.6 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections. B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

## 2.7 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required.

## 2.8 LOOSE STEEL LINTELS

- A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Weld adjoining members together to form a single unit where indicated.
- C. Size loose lintels for equal bearing of one inch per foot of clear span but not less than 8 inches bearing at each side of openings, unless otherwise indicated.

## 2.9 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  - 1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
    - a. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch x 8 inches long.
- C. Galvanize miscellaneous framing and supports in the following locations:
  - 1. All Exterior Locations.

#### 2.10MISCELLANEOUS STEEL TRIM

- A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.
- B. Galvanize miscellaneous framing and supports in the following locations:

- 1. All Exterior Locations.
- 2. Interior locations where indicated.

## 2.11SHELF AND RELIEVING ANGLES

- A. Fabricate shelf and relieving angles from steel angles of sizes indicated and for attachment to concrete framing. Provide slotted holes to receive 3/4 inch bolts, spaced not more than 6 inches from ends and not more than 24 inches o.c., unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support shelf/relieving angles from back-up masonry and concrete. Align expansion joints in angles with indicated expansion joints in cavity wall exterior wythe.
- C. Galvanize shelf angles to be installed on exterior concrete framing.
- D. Furnish wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.

## 2.12PIPE BOLLARDS

- A. Fabricate pipe bollards from Schedule 80 steel pipe. Cap bollards with 1/4 inch minimum thickness steel base plate.
- B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4 inch thick steel plate welded to bottom of sleeve.

#### 2.13FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Finish metal fabrications after assembly.

## 2.14STEEL AND IRON FINISHES

- A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:
  - 1. ASTM A 153 for galvanizing iron and steel hardware.
  - 2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.
- B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

- 1. Exteriors (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning."
- 2. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning:
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

## PART 3 - EXECUTION

## 3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

#### 3.2 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. 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 the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and 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 that no roughness shows after finishing and contour of welded surface

matches those adjacent.

# 3.3 SETTING LOOSE PLATES

- A. Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- B. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
  - 1. Use metallic nonshrink grout in concealed locations where not exposed to moisture; use nonmetallic nonshrink grout in exposed locations, unless otherwise indicated.
  - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

#### 3.4 INSTALLATION OF BOLLARDS

A. Anchor bollards in concrete by means of pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solid with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.

#### 3.5 ADJUSTING AND CLEANING

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
  - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 Section "Painting" of these specifications.
- C. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05500

# SECTION 06100 - ROUGH CARPENTRY

# PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of 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. Framing with dimension lumber.
  - 2. Wood grounds, nailers, and blocking.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 6 Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.

## 1.3 DEFINITIONS

A. Rough carpentry includes carpentry work not specified as part of other Sections and generally not exposed, unless otherwise specified.

## 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Material certificates for dimensional lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use as well as design values approved by the Board of Review of American Lumber Standards Committee.
- C. Wood treatment data as follows including chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material:
  - 1. For each type of preservative treated wood product include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
  - 2. For water-borne treated products include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.
  - 3. Warranty of chemical treatment manufacturer for each type of treatment.
- D. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction evidencing compliance of the following wood products

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with specified requirements and building code in effect for Project.

1. Power driven fasteners.

## 1.5 QUALITY ASSURANCE

- A. Testing Laboratory Qualifications: To qualify for acceptance, an independent testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying the progress of the Work.
- 1.6 DELIVERY, STORAGE, AND HANDLING
  - A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
    - 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

## PART 2 - PRODUCTS

## 2.1 LUMBER, GENERAL

- A. Lumber Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:
  - 1. NLGA National Lumber Grades Authority (Canadian).
  - 2. SPIB Southern Pine Inspection Bureau.
- C. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
  - 1. For exposed lumber furnish pieces with grade stamps applied to ends or back of each piece; or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.
- D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
  - 1. Provide dressed lumber, S4S, unless otherwise indicated.
  - Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

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# 2.2 DIMENSION LUMBER

- A. For light framing provide "Stud," "No. 3," or "Standard" grade lumber for stud framing (2 to 4 inches thick, 2 to 4 inches wide, 10 feet and shorter) and "Stud" or "No. 3" grade for other light framing (2 to 4 inches thick, 2 to 6 inches wide), any species.
- B. For light framing (2 to 4 inches thick, 2 to 4 inches wide) provide the following grade and species:
  - 1. "Standard" grade.
  - 2. Any species of specified grade.
- C. For structural light framing (2 to 4 inches thick, 2 to 4 inches wide), provide the following grade and species:
  - 1. "No. 2" grade.
  - 2. Same species as indicated for structural framing grade below.
- D. For structural framing (2 to 4 inches thick, 5 inches and wider), provide the following grade and species:
  - 1. "No. 2" grade.
  - Any species and grade that complies with the following requirements for species group as defined in Table 8.1a of N.F.P.A National Design Specification, for extreme fiber stress in bending "Fb" for single and repetitive members, and for modulus of elasticity "E":
    - a. "Fb" of 1500 psi for single member use and of 1400 psi for repetitive member use, and "E" of 1,500,000 psi.
- E. For exposed framing lumber provide material complying with the following requirements:
  - 1. Definition: Exposed framing refers to dimension lumber that is not concealed by other construction and is indicated to receive a stained or natural finish.
  - 2. Grading: Material hand-selected at factory from lumber of species and grade indicated below that complies with "Appearance" grade requirements of ALSC National Grading Rule; issue inspection certificate of inspection agency for selected material.
    - a. Same species and grade as indicated for structural framing.

## 2.3 BOARDS

- A. Concealed Boards: Where boards will be concealed by other work, provide lumber of 19 percent maximum moisture content (S-DRY or KD-19) and of following species and grade:
  - 1. Redwood "Construction Common" per RIS rules, Southern Pine "No. 2 Boards" per SPIB rules, or any species graded "Construction Boards" or "No. 3 Common" per WCLIB or WWPA rules.

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## 2.4 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: "Standard" grade light-framing-size lumber of any species or board-size lumber as required. "No. 3 Common" or "Standard" grade boards per WCLIB or WWPA rules or "No. 2 Boards" per SPIB rules.

## 2.5 CONSTRUCTION PANELS, GENERAL

- A. Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108.
- B. Trademark: Furnish construction panels that are each factory-marked with APA trademark evidencing compliance with grade requirements.

### 2.6 CONCEALED PERFORMANCE-RATED CONSTRUCTION PANELS

- A. General: Where construction panels are indicated for the following concealed types of applications, provide APA Performance-Rated Panels complying with requirements designated under each application for grade designation, span rating, exposure durability classification, edge detail (where applicable), and thickness.
- B. Wall and Roof Sheathing: APA RATED SHEATHING.
  - 1. Exposure Durability Classification: EXPOSURE 1.
  - 2. Span Rating: As required to suit stud and/or truss spacing indicated.

## 2.7 CONSTRUCTION PANELS FOR BACKING

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade designation, APA C-D PLUGGED EXPOSURE 1, in thickness indicated, or, if not otherwise indicated, not less than 15/32 inch.
- 2.8 AIR INFILTRATION BARRIER
  - A. Asphalt-saturated organic felt complying with ASTM D 226, Type I (No. 15 asphalt felt), unperforated.

## 2.9 FASTENERS

ROUGH CARPENTRY

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power Driven Fasteners: National Evaluation Report NER-272.
- D. Wood Screws: ANSI B18.6.1.
- E. Lag Bolts: ANSI B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

## 2.10METAL FRAMING ANCHORS

- A. General: Provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:
  - 1. Current Evaluation/Research Reports: Provide products for which model code evaluation/research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with the building code in effect for this Project.
  - 2. Allowable Design Loads: Provide products for which manufacturer publishes allowable design loads that are determined from empirical data or by rational engineering analysis and that are demonstrated by comprehensive testing performed by a qualified independent testing laboratory.
- B. Galvanized Steel Sheet: Steel sheet zinc-coated by hot-dip process on continuous lines prior to fabrication to comply with ASTM A 525 for Coating Designation G60 and with ASTM A 446, Grade A (structural quality); ASTM A 526 (commercial quality); or ASTM A 527 (lock-forming quality); as standard with manufacturer for type of anchor indicated.
  - 1. Use hot-dipped galvanized steel framing anchors for rough carpentry exposed to weather, in ground contact, or in area of high relative humidity, and where indicated.
- C. Painted Steel Sheet: ASTM A 366 (commercial quality) cold rolled steel sheet or ASTM A 570, Grade 33 (structural quality) hot-rolled steel sheet, as standard with manufacturer for type of anchor indicated, coated after fabrication with manufacturers standard, fast-curing, lead-free "universal primer" resistant to normal atmospheric corrosion.
  - 1. Use painted steel framing anchors for rough carpentry not exposed to weather, in

ground contact, or in area of high relative humidity.

## 2.11MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturer.
- B. Water Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbonate (IPBC) as its active ingredient.

## 2.12PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

- A. General: Where lumber or plywood is indicated as preservative-treated wood or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood). Mark each treated item with the AWPB or SPIB Quality Mark Requirements.
- B. Pressure-treat above-ground items with water-borne preservatives to a minimum retention of 0.25 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items 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, stripping, and similar concealed members in contact with masonry or concrete.
  - 3. Wood framing members less than 18 inches above grade.
  - 4. Wood floor plates installed over concrete slabs directly in contact with earth.
- C. Pressure-treat wood members in contact with the ground or fresh water with water-borne preservatives to a minimum retention of 0.40 pcf.
- D. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow

attachment of other construction.

- D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.
- E. Countersink nail heads on exposed carpentry work and fill holes.
- F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

## 3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

#### 3.3 WOOD FRAMING, GENERAL

- A. Framing Standard: Comply with N.F.P.A. "Manual for Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install framing composed of engineered wood products to comply with manufacturer's directions.
- C. Install framing members of size and spacing indicated.
- D. Anchor and nail as shown, and to comply with the following:
  - 1. National Evaluation Report No. NER-272 for pneumatic or mechanical driven staples, P-Nails, and allied fasteners.
  - 2. Published requirements of manufacturer of metal framing anchors.
  - 3. "Recommended Nailing Schedule" of referenced framing standard and with N.F.P.A. "National Design Specifications for Wood Construction."
  - 4. "Table No. II Recommended Nailing Schedule" of the Uniform Building Code.
  - 5. "Appendix C Recommended Nailing Schedule" of the BOCA National Building Code.
  - 6. "Table 1705.1 Fastening Schedule," of the Standard Building Code.
- E. Do not splice structural members between supports.
- F. Firestop concealed spaces of wood framed walls and partitions at the ceiling line of the top story. Where firestops are not automatically provided by the framing system used, use closely fitted wood blocks of nominal 2-inch-thick lumber of the same width

as framing members.

# 3.4 INSTALLATION OF CONSTRUCTION PANELS

- A. General: Comply with applicable recommendations contained in Form No. E30, "APA Design/Construction Guide Residential & Commercial," for types of construction panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Sheathing: Nail or staple to framing.
  - 2. Plywood Backing Panels: Nail to supports.

END OF SECTION 06100

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# SECTION 06105 - MISCELLANEOUS CARPENTRY

# 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. Rough carpentry work not specified elsewhere and generally intended for support of other work.
  - 2. Wood equipment bases.
  - 3. Miscellaneous blocking, grounds, nailers, and panels.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 3 Section "Cast-In-Place Concrete" for wood formwork.
  - 2. Division 6 Section "Interior Architectural Woodwork" for interior trim and ornamental elements specially fabricated for this Project.

#### 1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Wood treatment data from chemical treatment manufacturer. Include chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated material.
  - 1. Preservative Treatment: Include certification by treatment plant stating type of solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
  - 2. Waterborne Preservative Treatment: Include certification that moisture content of treated wood was reduced to levels specified prior to shipment to Project site.
  - 3. Fire-Retardant Treatment: Include certification by treating plant that treated wood complies with specified requirements.
  - 4. Warranty: Include warranty of chemical treatment manufacturer for each type of treatment.

## 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack material above ground level on uniformly spaced supports to prevent deformation.
  - 1. For material pressure treated with waterborne chemicals, place spacers between each bundle for air circulation.

#### PART 2 - PRODUCTS

#### 2.1 LUMBER, GENERAL

- A. Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Grade Stamps: Furnish lumber with each piece factory-marked with grade stamp of inspection agency that indicates grading agency, grade, species, moisture content at time of surfacing, and mill.
- C. Sizes: Provide nominal sizes indicated, complying with PS 20 except where actual sizes are specifically noted as being required.
- D. Surfacing: Dressed lumber, S4S, unless otherwise indicated.

### 2.2 DIMENSION LUMBER FOR CONCEALED CONDITIONS

- A. Species: Any wood species listed by PS 20.
- B. Moisture Content: S-DRY, KD 19 or MC 19 (19 percent maximum moisture content).
- C. Grade: No. 2 or standard grade.

#### 2.3 BOARDS FOR CONCEALED CONDITIONS

- A. Species: Any wood species listed by PS 20.
- B. Moisture Content: S-DRY, KD 19 or MC 19 (19 percent maximum moisture content).
- C. Grade: No. 2, 2 Common, or Construction Boards.

## 2.4 CONSTRUCTION PANELS

A. Standards: Comply with requirements of PS 1 Voluntary Product Standard "Construction and Industrial Plywood" for veneer plywood and APA PRP-108 "Performance Standards and Policies for Structural-Use Panels" for performance-rated panels.

- 1. Trademark: Furnish construction panels that are each factory-marked with APA trademark for grade specified.
- B. Miscellaneous Concealed Plywood: C-C Plugged Exterior, thickness as indicated but not less than 1/2 inch nominal.
- C. Electrical/Telephone Backing Panels: APA-RATED SHEATHING, Exposure 1, fire-retardant treated, thickness as indicated but not less than 15/32 inch.

# 2.5 FASTENERS

- A. General: Where miscellaneous carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel.
- B. Nails, Wire, Brads and Staples: FS FF-N-105.
- C. Bolts: ASTM A 307, Grade A; with ASTM A 563 hex nuts and flat washers.

## 2.6 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

- A. General: Obtain preservative-treated lumber complying with AWPA Standard C2. Mark each treated item with AWPB or SPIB Quality Mark Requirements. Coat surfaces cut after treatment to comply with AWPA M4.
- B. Above-Ground Wood Treatment: Pressure treat with waterborne preservatives to a minimum retention of 0.25 pcf.
  - 1. Kiln-dry interior dimension lumber after treatment to 19 percent maximum moisture content.
  - 2. Kiln-dry interior construction panels after treatment to 15 percent maximum moisture content.
  - 3. Treat wood items indicated and in the following circumstances:
    - a. In contact with roofing, flashing, or waterproofing.
    - b. In contact with masonry or concrete.
    - c. Within 18 inches of grade.
- C. Ground-Contact Wood Treatment: Pressure treat with waterborne preservatives to a minimum retention of 0.40 pcf.

## 2.7 FIRE-RETARDANT TREATMENT BY PRESSURE PROCESS

A. General: Identify treated wood with appropriate classification marking of Underwriters Laboratories Inc. or other testing and inspection agency acceptable to authorities

having jurisdiction.

- B. Dimension Lumber: Comply with AWPA C20.
  - 1. Treatment Types: Interior Type A for protected wood and Exterior Type for wood exposed to weather.
- C. Plywood: Comply with AWPA C27.
  - 1. Treatment Types: Interior Type A for protected wood and Exterior Type for wood exposed to weather.
- D. Inspect each piece after drying and discard damaged or defective pieces.

## PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
  - A. Discard units of material with defects that impair quality of miscellaneous carpentry and in sizes that would require an excessive number or poor arrangement of joints.
  - B. Cut and fit miscellaneous carpentry accurately. Install members plumb and true to line and level.
  - C. Coat cut edges of preservative-treated wood to comply with AWPA M4.
  - D. Securely fasten miscellaneous carpentry as indicated and according to applicable codes and recognized standards.
  - E. Countersink nail heads on exposed carpentry work and fill holes.
  - F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

#### 3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install where shown and where required for screeding or attachment of other work. Cut and shape to required size. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.

## 3.3 CONSTRUCTION PANELS

A. Comply with applicable installation recommendations in APA Form E30 "Design/Construction Guide--Residential & Commercial."

END OF SECTION 06105

# SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

## 1PART - GENERAL

#### 1.1 SUMMARY

A. This Section includes interior woodwork including for the following applications:

- 1. Standing and running trim.
- 2. Wood cabinets.
- 3. Plastic-laminate cabinets.
- 4. Plastic-laminate countertops.
- 5. Solid-surfacing-material countertops.
- 6. Shop finishing of woodwork.
- B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips, unless concealed within other construction before woodwork installation.
- C. Rough carriages for stairs are interior architectural woodwork.
- 1. See Division 6 Section "Rough Carpentry" for platform framing and other rough framing associated with stairwork.
- 1.2 SUBMITTALS
- A. Product Data: For the following:
- 1. Cabinet hardware and accessories.
- 2. Handrail brackets.
- 3. Finishing materials and processes.
- B. Shop Drawings: Include location of each item, plans and elevations, large-scale details, attachment devices, and other components.
- C. Samples:
- 1. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
- 2. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.
- 3. Plastic-laminate-clad panel products, for each type, color, pattern, and surface finish.
- 4. Thermoset decorative-overlay surfaced panel products, for each type, color, pattern, and surface finish.
- 5. Solid-surfacing materials.
- 1.3 QUALITY ASSURANCE
- A. Installer Qualifications: Fabricator of woodwork.

- B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
- 1.4 PROJECT CONDITIONS
- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- 2PART PRODUCTS
- 2.1 MATERIALS
- A. Wood for Opaque Finish:
- 1. Species: Eastern white pine, sugar pine, or western white pine.
- B. Wood Products:
- 1.
- 2. Hardboard: AHA A135.4.
- 3. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
- 4. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
- 5. Softwood Plywood: DOC PS 1, Medium Density Overlay.
- 6. Hardwood Plywood and Face Veneers: HPVA HP-1.
- C. Thermoset Decorative Overlay: Particleboard or medium-density fiberboard with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- D. High-Pressure Decorative Laminate: NEMA LD 3.
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- a. Formica Corporation.
- b. International Paper; Decorative Products Div.
- c. Laminart.
- d. Pioneer Plastics Corp.
- e. Westinghouse Electric Corp.; Specialty Products Div.
- f. Wilsonart International; Div. of Premark International, Inc.
- 2.2 FIRE-RETARDANT-TREATED MATERIALS
- A. Fire-Retardant-Treated Lumber and Plywood: Materials impregnated with fire-retardant chemical formulations to comply with AWPA C20 (lumber) and AWPA C27 (plywood), Exterior Type or Interior Type A. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Kiln-dry material after treatment.

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- B. Fire-Retardant Particleboard: Panels made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture with flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
- C. Fire-Retardant Fiberboard: ANSI A208.2 medium-density fiberboard panels made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture with flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

## 2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials for a complete installation of architectural woodwork, except for items specified in Division 8 Section "Door Hardware."
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, self-closing (GRASS 3703 self closing 120 or equal).
- D. Wire Pulls: Back mounted, 4 inches (100 mm) long, 5/16 inches (8 mm) in diameter (Liberty P604B6, matte chrome or equal).
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071, with shelf rests, B04081 (BAHBRIDGE 3227 or equal).
- F. Drawer Slides: Side -mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091 (GRASS 6650 or equal) and rated for the following loads:
- 1. Box Drawer Slides: 100 lbf (440 N).
- G. Exposed Hardware Finishes: Complying with BHMA A156.18 for BHMA finish number indicated.
- 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- 2.4 INSTALLATION MATERIALS
- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

#### 2.5 FABRICATION

- A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
- 1. Interior Woodwork Grade: Premium complying with the referenced quality standard.

- 2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs.
- 3. Seal edges of openings in countertops with a coat of varnish.
- 4. Install glass to comply with applicable requirements in Division 8 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.
- 5. For trim items wider than available lumber, use veneered construction. Do not glue for width.
- 6. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- 7. Assemble casings in plant except where limitations of access to place of installation require field assembly.
- B. Plastic-Laminate Cabinets:
- 1. AWI Type of Cabinet Construction: Flush overlay.
- 2. Laminate Cladding for Exposed Surfaces: High-pressure decorative of grade indicated.
- a. Horizontal Surfaces Other Than Tops: HGS.
- b. Postformed Surfaces: HGP.
- c. Vertical Surfaces: HGS.
- d. Edges: PVC tape, .5 mm minimum thickness, matching laminate in color, pattern, and finish and/or PVC T-mold matching laminate in color, pattern, and finish.
- 3. Materials for Semiexposed Surfaces Other Than Drawer Bodies: Thermoset decorative overlay.
- a. Drawer Sides and Backs: Thermoset decorative overlay.
- b. Drawer Bottoms: Thermoset decorative overlay.
- 4. Colors, Patterns, and Finishes: As selected from manufacturer's full range.
- C. Plastic-Laminate Countertops:
- 1. High-Pressure Decorative Laminate Grade: HGS.
- 2. Colors, Patterns, and Finishes: As selected from manufacturer's full range.
- 3. Edge Treatment: Same as laminate cladding on horizontal surfaces as indicated.
- 4. Core Material at Sinks: Exterior-grade plywood.
- 2.6 SHOP FINISHING
- A. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling.

# 3PART - EXECUTION

# 3.1 INSTALLATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas and examine and complete work as required, including removal of packing and backpriming before installation.
- B. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in this Section for type of woodwork involved.
- C. Quality Standard: Install woodwork to comply with WIC Section 26 for the same grade specified in this Section for type of woodwork involved.
- D. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches . Shim as required with concealed shims.
- E. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails and/or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
- H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
- 1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
- I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

END OF SECTION 06402

# SECTION 07190 - WATER REPELLENTS

# 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 surface preparation and application of clear water repellent coating to the following vertical and nontraffic horizontal exposed surfaces:
  - 1. Exterior brick masonry.
- B. Related Sections: The following sections contain requirements that relate to this Section:
  - 1. Division 3 Sections for concrete work including floor sealers and curing agents, precast concrete, and concrete restoration and cleaning.
  - 2. Division 4 Section for brick, concrete unit masonry, and masonry restoration and cleaning.
  - 3. Division 7 Section "Joint Sealants" for joint fillers and sealants.
  - 4. Division 9 Section "Painting" for paints and coatings.

# 1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of Contract and Division 1 Specification Sections.
- B. Product data including manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface specified, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.
- C. Certification by water repellent manufacturer that products supplied comply with

local regulations controlling use of volatile organic compounds (VOC).

D. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of water repellents with Performance Requirements specified in the "Quality Assurance" article.

# 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who employs only persons trained and approved by water repellent manufacturer for installation of manufacturer's products.
- B. Manufacturer Qualifications: Firm experienced in manufacturing products similar to those indicated for this Project and that has a record of successful in-service performance.
- C. Regulatory Requirements: Comply with applicable rules of the pollution-control regulatory agency having jurisdiction in the Project locale regarding volatile organic compounds (VOC) and use of hydrocarbon solvents.
- D. Project Mockup: Apply water repellent to mockup, either partial or full coverage as directed, before proceeding with installation. Comply with installation requirements of this Section.
- E. Performance Requirements: Indicate test results for water repellents on substrate simulating Project conditions, as close as possible. Use same materials and methods of application to be used on the Project.
  - 1. Absorption Tests: Comparison of treated and untreated specimens:
    - a. Brick: ASTM C 67.
  - 2. Water Vapor Transmission: ASTM E 96. Comparison of treated and untreated specimens.
  - 3. Water Penetration and Leakage Through Masonry: ASTM E 514.

# 1.5 PROJECT CONDITIONS

- A. Weather and Substrate Conditions: Do not proceed with application of water repellent (except with written recommendation of manufacturer) under any of the following conditions:
  - 1. Ambient temperature is less than 50 deg F (10 deg C).

- 2. Substrate surfaces have cured for less than two month.
- 3. Rain or temperatures below 40 deg F (4 deg C) are predicted for a period of 24 hours.
- 4. Earlier than 3 days after surfaces became wet.
- 5. Windy condition such that repellent may be blown to vegetation or substrates not intended.

# 1.6 WARRANTY

- A. Warranty: Submit a written warranty, executed by the Applicator and water repellent manufacturer covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the specified warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the contractor under the contract documents.
  - 1. Warranty Period: 5 years from date of Substantial Completion.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
- B. Products: Subject to compliance with requirements, provide one of the following: NOTE: Product shall meet or exceed Hydrozo Enviroseal 20, by Hydrozo, Inc. Technical Data.
  - 1. Silane, 20 Percent Solids:
    - a. Sil-Act ATS 22, Advanced Chemical Technologies.
    - b. Aridox 20, Anti Hydro Company, Inc.
    - c. Versaseal "S" 20, Applied Polymers of America, Inc.
    - d. Weather Worker S-20, Dayton Superior Corp.
    - e. Chem-Trete BSM 20, Huls America Inc.
    - f. Hydrozo Enviroseal 20, Hydrozo Inc.
    - g. Pentane, L & M Construction Chemicals, Inc.
    - h. Klere-Seal 920-S, Pecora Corporation.
    - i. Penetrating Sealer 20, Sonneborn Building Products.

- j. Stontite S19 20, Stonhard, Inc.
- k. Baracade Silane 20 Percent, Tamms Industries.
- I. Rainstopper 120, Textured Coatings of America, Inc.

# 2.2 WATER REPELLENTS

A. Silane, 20 Percent Solids: Penetrating water repellent. A monomeric compound containing approximately 20 percent alkyltrialkoxysilanes with alcohol, mineral spirits, water, or other proprietary solvent carrier.

# PART 3 - EXECUTION

# 3.1 PREPARATION

- A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's instructions to ensure that surface is sufficiently dry.
- B. Test for pH level, according to repellent manufacturer's instructions to ensure chemical bond to silicates minerals.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass where there is the possibility of the water repellent being deposited on surfaces. Cover live plants and grass. Immediately clean water repellent from adjoining surfaces, complying with manufacturer's cleaning recommendations.
- D. Coordination with Sealants: Do not apply water repellent until the sealants for joints adjacent to surfaces receiving water repellent treatment have been installed and cured.
  - 1. Water repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.
- E. Test Application: Prior to performing water repellent work, including bulk purchase or delivery of products, prepare a small application in an unobtrusive location and in a manner acceptable to the Architect to demonstrate the final effect (visual, physical, and chemical) of planned installation. Proceed with work only after Architect accepts test application or as otherwise directed.

1. Revisions of planned installation, if any, and as requested by Architect, will be by change order where it constitutes a departure from requirements of contract documents at time of contracting.

# 3.2 INSTALLATION

- A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's instructions and recommendations using airless spraying procedure unless otherwise indicated.
- B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if printed recommendations are not applicable to Project conditions.
- C. Remove protective coverings from adjacent surfaces.

END OF SECTION 07190

### SECTION 07200 – THERMAL INSULATION

#### 1.1 SECTION INCLUDES

- A. Spray-in-place rigid polyurethane foam insulation in various assemblies, to provide an air barrier and improved thermal resistance.
- B. Open cell and closed cell.

### 1.2 RELATED SECTIONS

- A. Section 04200 Unit Masonry.
- B. Section 05400 Cold Formed Metal Framing.
- C. Section 06100 Rough Carpentry.
- D. Section 07100 Waterproofing.
- E. Section 07260 Vapor Barrier.
- F. Section 07800 Fireproofing.
- G. Section 07840 Thermal Barrier.
- H. Section 09250 Gypsum Board.

#### 1.3 REFERENCES

#### **SEALECTION 500**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM C 518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 2. ASTM D 1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
  - 3. ASTM D 1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
  - 4. ASTM D 1623 Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
  - 5. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 6. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials.
  - 7. ASTM E 283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

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- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM C 518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

- 2. ASTM D 1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- 3. ASTM D 1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- 4. ASTM D 1623 Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
- 5. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- 6. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials.
- 7. ASTM E 283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- C. International Code Council International Residential Code:
  - 1. Section 103.7 Alternate Materials and Methods.
  - 2. 2006 IRC Section R314 Foam Plastic Insulation.
  - 3. 2009 IRC Section R316 Foam Plastic Insulation.
  - 4. Section 806.4 Unvented Attic Assemblies.
- D. International Code Council International Building Code:
  - 1. Section 104.11 Alternative materials, design and methods of construction and equipment.
  - 2. Section 2603 Foam Plastic Insulation.
- 1.4 SUBMITTALS
  - A. Submit under provisions of Section 01300.
  - B. Before commencing work, submit in accordance with local code.
    - 1. Submit technical data sheets and samples as required by local code officials.
    - 2. Submit the technical data sheet from the manufacturer showing the test results from the ASTM E84 (Surface Burning Characteristics).
  - C. Product Data: Manufacturer's data sheets on each product to be used, including:
    - 1. Preparation instructions and recommendations.
    - 2. Storage and handling requirements and recommendations.
    - 3. Installation methods.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Contractor performing work under this section shall be trained by DEMILEC USA<sup>®</sup> in the art of applying spray polyurethane foam insulation.
  - 2. Provide current DEMILEC USA<sup>®</sup> Authorized Contractor Certificate.
- B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish areas designated by Architect.
  - 2. Do not proceed with remaining work until installation is approved by Architect.
  - 3. Rework mock-up area as required to produce acceptable work.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

#### THERMAL INSULATION

- B. Material shall be stored in a safe manner and where the temperatures are in the limits specified by the material manufacturer.
- C. Empty containers shall be removed from site on a daily basis.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

## 1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Ventilate insulation application area in accordance with the Spray Foam Coalition's Guidance<sup>1</sup> on best practices for the installation of Spray Polyurethane Foam.
- C. Protect workers as recommended by the Spray Foam Coalition's Guidance<sup>2</sup> on best practices for the installation of Spray Polyurethane Foam.
- D. Protect adjacent surfaces, windows, equipment and site areas from damage of overspray.

#### 1.8 WARRANTY

- A. Manufacturer's Warranty: DEMILEC USA<sup>®</sup> warrants spray-in-place urethane foam insulation, when installed by certified contractors using factory-trained applicators and applied in accordance with the Installation Instructions<sup>3</sup>, will perform as stated in the Product Technical Data Sheet.
  - 1. This warranty is in effect throughout the life of the building provided the original purchaser registers with the Warranty Department of the Manufacturer within thirty days of occupancy.
  - 2. Manufacturer's sole responsibility under this Limited Lifetime Warranty shall be to repair or replace any defective Product at the cost of the material only.
  - 3. Manufacturer shall not be responsible for labor cost or any other costs whatsoever related to, or in connection with the removal or installation of either the original or replacement product.

#### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

<sup>&</sup>lt;sup>1</sup><u>http://www.spraypolyurethane.org/GoodPractices</u>

<sup>&</sup>lt;sup>2</sup> <u>http://www.spraypolyurethane.org/WorkerProtection</u>

<sup>&</sup>lt;sup>3</sup> <u>http://www.demilecusa.com/wp-content/uploads/2013/02/Demilec-APX-Product-Application-Guide.pdf</u>

- A. Acceptable Manufacturer: DEMILEC USA<sup>\*</sup>; 2925 Galleria Dr, Arlington, TX 76011. Toll Free Tel: (877) DEMILEC. Tel: (817) 640-4900. Fax: (817) 633-2000. Email: specs@demilecusa.com. Web: http://www.demilecusa.com
- B. Substitutions: Equivalent as judged by Architect
  - 1. Contact DEMILEC USA's Engineering Department for product comparison data
    - a. 817-640-4900
    - b. <u>specs@demilecusa.com</u>
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

## 2.2 SPRAY FOAM INSULATION (SEALECTION 500)

- A. Spray Applied Rigid Polyurethane Foam Insulation System:
  - 1. Product: HEATLOK SOY<sup>®</sup> 200 PLUS Manufactured by DEMILEC USA<sup>®</sup>, Arlington, TX
  - 2. Product Approval:
    - a. International Code Council Evaluation Services Report #3210
    - b. Approved for non-structural walls in building types I, II, III, IV, and V construction under IBC and dwellings for IRC.
    - c. Approved for exterior walls in building types I, II, III, and IV construction. (In Progress)
    - d. Passed AC 377 Appendix X compliant NFPA 286.
  - 3. Installation:
    - a. Application with a prescriptive Thermal Barrier:
      - Up to 9-1/4 inches (235 mm) for wall cavities and 11-1/4 inches (286mm) in floors or ceilings with 1/2 inch gypsum wall board or equivalent 15 minute thermal barrier in accordance with IBC 2603.4 or IRC R316.4.
    - b. Application without a Thermal or Ignition Barrier (exposed foam)
      - 1) Up to 9-1/4 inches (235mm) in walls and 11-1/4 inches (286mm) in floors and ceilings with all foam surfaces covered with BLAZELOK<sup>TM</sup> TBX intumescent coating.
    - c. Application without a Thermal or Ignition Barrier (exposed foam)
      - Up to 5-1/2 inches (171 mm) in walls and 7-1/2 inches (292) mm) in floors and ceilings with all foam surfaces covered with 12 dry mils of BLAZELOK<sup>™</sup> TBX intumescent coating.
    - d. Attics and Crawlspaces: Passed AC 377 Appendix X compliant NFPA 286.
      - 1) Up to 7-1/2 inches (190.5mm) on vertical surfaces and 11-1/2 (292mm) inches on the underside of the space with no intumescent coating
  - 4. Physical Properties:
    - a. Density (ASTM D 1622): 2.1 lb/cf (0.034 gm/cu. cm).
    - b. Thermal Resistance (ASTM C 518):

Aged R value at 1 inch (180 days at 76 degrees F (23 degrees C)) – R-7.4 (sf.h degree F/BTU)

- c. Water Vapor Permeance @ 1.2"(ASTME 96-05): < 1 perms (is a vapor barrier per IBC Section 202 definitions at 1.2")
- d. Air Permeance @ 75 Pa @ 1" (ASTME 2178-03): 0.02 L/sm<sup>2</sup>
- e. Air Leakage of Air Barrier Assembly (static loading to 600 Pa and gust loading to 1,200 PA) Complies with ABAA requirements (ASTME 2357-05): <0.02L/sm<sup>2</sup>

- f. Compressive Strength (ASTM D 1621): 28.7 psi (198 kPa).
- g. Tensile Strength (ASTM D 1623): 46.2 psi
- h. Off Gassing Test (VOC Emissions) (CGSB 51.23-92): Pass (no toxic vapor).
- i. Surface Burning Characteristics (ASTM E 84) 4 inches: Class I. Flame Spread Index 20, Smoke Developed Index 400.
- j. Closed Cell Content (ASTM D2856) : >90%
- k. Equipment used to apply the foam insulation shall have fixed ratio positive displacement pumps and approved by foam manufacturer.
- 5. Equipment used to apply the Water Based intumescing coating shall be an airless sprayer approved by the manufacturer.
- B. Water Based Intumescing coating:
  - 1. Product: BLAZELOK<sup>™</sup> TBX Intumescing Coating, Distributed by DEMILEC USA<sup>®</sup>, Manufactured by TPR<sup>2</sup>.
  - 2. Application: Follow manufacturer's application recommendations.
  - 3. Physical Properties:
    - 1) BLAZELOK<sup>™</sup> TBX
      - (a) Approval: Complies with the 2009 IBC<sup>®</sup> 2603.9 and 803.2; 2009 IRC<sup>®</sup> 302.9.4 and 316.6; 2006 IRC<sup>®</sup> 314.6 and 315.4 and the NFPA 101 paragraph 10.2.3.7.2 for use without a prescriptive thermal barrier.
      - (b) Surface Burning Characteristics (ASTM E 84): Class I. Flame Spread Index <25, Smoke Developed Index <50.</li>
      - (c) Expands up to 2000 percent.
      - (d) Flash Point: None
      - (e) Volatility/VOC: < 50 g/L
      - (f) Non-toxic, drain safe, water based, non-fuming.
      - (g) Color: Dull Flat White / Gray
        - (1) Do not add tint
        - (2) Wait minimum 24 hours prior to top coating with quality latex paint. Verify dryness with moisture meter.

## 2.4 SPRAY FOAM INSULATION (HEATLOK SOY 200 PLUS)

- A. Spray Applied Rigid Polyurethane Foam Insulation System:
  - 1. Product: HEATLOK SOY<sup>®</sup> 200 PLUS Manufactured by DEMILEC USA<sup>®</sup>, Arlington, TX
  - 2. Product Approval:
    - a. International Code Council Evaluation Services Report #3210
    - b. Approved for non-structural walls in building types I, II, III, IV, and V construction under IBC and dwellings for IRC.
    - c. Approved for exterior walls in building types I, II, III, and IV construction. (In Progress)
    - d. Passed AC 377 Appendix X compliant NFPA 286.
  - 3. Installation:
    - a. Application with a prescriptive Thermal Barrier:

- 1) Up to 9-1/4 inches (235 mm) for wall cavities and 11-1/4 inches (286mm) in floors or ceilings with 1/2 inch gypsum wall board or equivalent 15 minute thermal barrier in accordance with IBC 2603.4 or IRC R316.4.
- b. Application without a Thermal or Ignition Barrier (exposed foam)
  - 1) Up to 9-1/4 inches (235mm) in walls and 11-1/4 inches (286mm) in floors and ceilings with all foam surfaces covered with BLAZELOK<sup>™</sup> TBX intumescent coating.
- c. Application without a Thermal or Ignition Barrier (exposed foam)
  - 1) Up to 5-1/2 inches (171 mm) in walls and 7-1/2 inches (292) mm) in floors and ceilings with all foam surfaces covered with 12 dry mils of BLAZELOK<sup>™</sup> TBX intumescent coating.
- d. Attics and Crawlspaces: Passed AC 377 Appendix X compliant NFPA 286.
  - 1) Up to 7-1/2 inches (190.5mm) on vertical surfaces and 11-1/2 (292mm) inches on the underside of the space with no intumescent coating
- e. Use on Attic Floors
  - 1) Up to 7-1/2 inches (190.5mm) between and over the joists in attic floors
- f. Use as Water-resistive Barrier:
  - 1) Minimum 1-1/2 inches (38mm) continuous layer applied to suitable exterior substrate. Refer to ESR # 3210 Section 4.5
- g. One-hour Fire-resistance-rated Wall Assembly: Nonload-bearing:
  - 1) Refer to ESR #3210 Section 4.6

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Commencement of work outlined in this section shall be deemed as acceptance of existing work and conditions.

#### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- 3.3 INSTALLATION

#### **SEALECTION 500**

THERMAL INSULATION

A. Install in accordance with manufacturer's instructions. Apply as recommended by manufacturer to thickness as indicated on drawings. Protection: Except as provided in Section 314.5 and Section 314.6 of the 2006 International Residential Code, Section316.4, 316.5 and Section 316.6 of the 2009 and 2012 International Residential Code and Section 2603.4 and Section 2603.9 of the International Building Code, all plastic insulation shall be separated from the interior of the building by an approved thermal barrier of 1/2 inch (13 mm) gypsum wallboard or equivalent thermal barrier material. HEATLOK Soy<sup>®</sup> 200 PLUS with DEMILEC<sup>™</sup> TBX depending on the application can be used as an interior finish in lieu of a prescribed Thermal barrier, for more information or contact DEMILEC USA<sup>°</sup>'s Engineering Department for assistance, 817-640-4900. (In Progress)

#### HEATLOK SOY 200 PLUS

B. Install in accordance with manufacturer's instructions. Apply as recommended by manufacturer to thickness as indicated on drawings.
Protection: Except as provided in Section 314.5 and Section 314.6 of the 2006 International Residential Code, Section316.4, 316.5 and Section 316.6 of the 2009 and 2012 International Residential Code and Section 2603.4 and Section 2603.9 of the International Building Code, all plastic insulation shall be separated from the interior of the building by an approved thermal barrier of 1/2 inch (13 mm) gypsum wallboard or equivalent thermal barrier material. HEATLOK Soy<sup>®</sup> 200 PLUS with DEMILEC<sup>™</sup> TBX depending on the application can be used as an interior finish in lieu of a prescribed Thermal barrier, for more information or contact DEMILEC USA<sup>°</sup>'s Engineering Department for assistance, 817-640-4900. (In Progress)

## 3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion. END OF SECTION

# SECTION 07311 - ASPHALT SHINGLES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Asphalt shingles.
  - 2. Underlayment.
  - 3. Ridge vents

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product test reports.
- C. Samples for Verification: For the following products, of sizes indicated, to verify color selected:
  - 1. Asphalt Shingle: Full size.
  - 2. Ridge and Hip Cap Shingles: Full size.
  - 3. Ridge Vent: 12-inch long Sample.
  - 4. Exposed Valley Lining: 12 inches square.
  - 5. Self-Adhering Underlayment: 12 inches square.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain ridge shingles, ridge vents, underlayment and self-adhering sheet; underlayment from single source from single manufacturer.
- B. Fire-Resistance Characteristics: Where indicated, provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
  - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated, weather tight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
  - 1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

## 1.6 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Manufacturing defects.
    - b. Structural failures including failure of asphalt shingles to self-seal after a reasonable time.
  - 2. Material Warranty Period:
    - a. 50-year Limited Warranty
    - b. 20-year Full Start Period
    - c. 15-year Limited Warranty Coverage for Winds up to 110 mph
    - d. 10-year Algae Relief-Alge Cleaning Limited Warranty
    - ·

## PART 2 - PRODUCTS

# 2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Multitab-Strip Asphalt Shingles: ASTM D 3462, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
- Β.
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product by the following:
  - a. TAMKO Roofing Products, Inc. HERITAGE Premium Shingle
- 2. Tab Arrangement: Three tabs, regularly spaced
- 3. Algae Resistance: Granules treated to resist algae discoloration.

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### 2.2 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226 or ASTM D 4869, Type II, asphalt-saturated organic felts, nonperforated.

#### 2.3 RIDGE VENTS

A. Rigid Ridge Vent: Manufacturer's standard rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with external deflector baffles; for use under ridge shingles.

#### 2.4 1. Available Products: (or equal)

- a. Air Vent Inc., a Certain Teed Company, Shingle Vent II.
- b. Cor-A-Vent Inc.; V-Series
- c. GAF Materials Corporation; Cobra Rigid Vent II.

#### 2.5 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanizedsteel wire shingle nails, minimum 0.120-inch- diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through OSB or plywood sheathing.
  - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.

#### 2.6 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
  - 1. Sheet Metal: Copper
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.
  - 1. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.

C. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with **roofing** nails.

## 3.3 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
  - 1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.
- C. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.

D. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

#### 3.4 ASPHALT SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed at least 7 inches wide with self-sealing strip face up at roof edge.
  - 1. Extend asphalt shingles 1/2 over fasciae at eaves and rakes.
  - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt shingle strips with a minimum of five roofing nails located according to manufacturer's written instructions.
- E. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- F. Ridge Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
  - 1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION 07311

# SECTION 07 25 00 WEATHER BARRIERS

# PART 1 - GENERAL

# **1.1 SECTION INCLUDES**

- A. Weather barrier membrane (DuPont<sup>™</sup> Tyvek<sup>®</sup> CommercialWrap<sup>®</sup>)
- B. Seam Tape (DuPont<sup>™</sup> Tyvek<sup>®</sup> Tape)
- C. Flashing (DuPont<sup>™</sup> FlexWrap<sup>™</sup>, DuPont<sup>™</sup> FlexWrap<sup>™</sup> NF, DuPont<sup>™</sup> StraightFlash<sup>™</sup>, DuPont<sup>™</sup> StraightFlash<sup>™</sup> VF, and/or DuPont<sup>™</sup> Thru-Wall Flashing)
- D. Fasteners (DuPont<sup>™</sup> Tyvek<sup>®</sup> Wrap Caps)

# **1.2 REFERENCES**

- A. ASTM International
  - 1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
  - 2. ASTM C1193; Standard Guide for Use of Joint Sealants
  - 3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
  - 4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
  - 5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
  - 6. ASTM E96; Test Method for Water Vapor Transmission of Materials
  - 7. ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
  - 8. ASTM E2178; Test Method for Air Permeance of Building Materials
  - 9. ASTM E2357; Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
- B. AATCC American Association of Textile Chemists and Colorists
  - 1. Test Method 127 Water Resistance: Hydrostatic Pressure Test
- C. TAPPI
  - 1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
  - 2. Test Method T-460; Air Resistance (Gurley Hill Method)

# **1.3 SUBMITTALS**

- A. Refer to Section [01 33 00 Submittal Procedures] [insert section number and title].
- B. Product Data: Submit manufacturer current technical literature for each component.
- C. Samples: Weather Barrier Membrane, minimum 8-1/2 inches by 11 inch. Manfacturer's written installation instructions.
- E. Closeout Submittals
  - 1. Refer to Section [01 78 00 Closeout Submittals] [insert section number and title].
  - 2. Weather Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

## WEATHER BARRIER

# **1.4 QUALITY ASSURANCE**

- A. Qualifications
  - 1. Installer shall have experience with installation of commercial weather barrier assemblies under similar conditions.
  - 2. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.
  - 3. Source Limitations: Provide commercial weather barrier and accessory materials produced by single manufacturer.
- B. Mock-up
  - 1. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.
    - a. Mock-up size: [10 feet by 10 feet] [insert size].
    - b. Mock-up Substrate: Match wall assembly construction, including window opening.
    - c. Mock-up may [not] remain as part of the work.
  - 2. Contact manufacturer's designated representative prior to weather barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.
- C. Pre-installation Meeting
  - 1. Refer to Section [01 31 19 Project Meetings] [insert section number and title].
  - 2. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, Engineer, Installer, Owner's Representative, and Weather Barrier Manufacturer's Designated Representative.
  - 3. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

## 1.5 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section [01 60 00 Product Requirements] [insert section number and title].
- B. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store weather barrier materials as recommended by weather barrier manufacturer.

## 1.6 SCHEDULING

- A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.
- B. Schedule installation of weather barrier materials and exterior cladding within nine months of weather barrier assembly installation.

# **1.7 WARRANTY**

- **B.** Special Warranty
  - 1. Special weather-barrier manufacturer's warranty for weather barrier for a period of ten (10) years from date of purchase.
  - 2. Pre-installation meetings and jobsite observations by weather barrier manufacturer for warranty are required.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURER

A. DuPont; 4417 Lancaster Pike, Chestnut Run Plaza 728, Wilmington, DE 19805; 1-800-44-TYVEK (8-9835); <u>http://www.construction.tyvek.com</u>

# 2.2 MATERIALS

- A. Basis of Design: spunbonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPont<sup>™</sup> Tyvek<sup>®</sup> CommercialWrap<sup>®</sup> and related assembly components.
  - B. Performance Characteristics:
    - 1. Air Penetration: 0.001 cfm/ft<sup>2</sup> at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. ≤0.04 cfm/ft<sup>2</sup> at 75 Pa, when tested in accordance with ASTM E2357
    - 2. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
    - 3. Water Penetration Resistance: 280 cm when tested in accordance with AATCC Test Method 127.
    - 4. Basis Weight: 2.7 oz/yd<sup>2</sup>, when tested in accordance with TAPPI Test Method T-410.
    - 5. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
    - 6. Tensile Strength: 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
    - 7. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
    - 8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 10, Smoke Developed: 10.

# 2.3 ACCESSORIES

- A. Seam Tape: 3 inch wide, DuPont<sup>™</sup> Tyvek<sup>®</sup> Tape for commercial applications.
- B. Fasteners:
  - 1. DuPont<sup>™</sup> Tyvek<sup>®</sup> Wrap Cap Screws, as distributed by DuPont: 1-5/8 inch rust resistant screw with 2inch diameter plastic cap or manufacturer approved 1-1/4" or 2" metal gasketed washer
  - Tyvek<sup>®</sup> Wrap Caps, as distributed by DuPont: #4 nails with large 1-inch plastic cap fasteners, or 1inch plastic cap staples with leg length sufficient to achieve a minimum penetration of 5/8-inch into the wood stud.
  - 3. Masonry tap-con fasteners with Tyvek<sup>®</sup> Wrap Caps as distributed by DuPont: 2-inch diameter

# WEATHER BARRIER

plastic cap fasteners.

- C. Sealants
  - 1. Provide sealants that comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions.
  - 2. Products:
    - a. DuPont<sup>™</sup> Commercial Sealant
    - c. DuPont<sup>™</sup> Residential Sealant
    - b. Sealants recommended by the weather barrier manufacturer.
- D. Adhesives:
  - 1. Provide adhesive recommended by weather barrier manufacturer.
  - 2. Products:
    - a. Liquid Nails<sup>®</sup> LN-109
    - b. Denso Butyl Liquid
    - c. 3M High Strength 90
    - d. SIA 655
    - e. Adhesives recommend by the weather barrier manufacturer.
- E. Primers:
  - 1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.
  - 2. Products:
    - a. 3M High Strength 90
    - b. Denso Butyl Spray
    - c. SIA 655
    - d. Permagrip 105
    - e. ITW TACC Sta' Put SPH
    - f. Primers recommended by the flashing manufacturer
- F. Flashing
  - 1. DuPont<sup>™</sup> FlexWrap<sup>™</sup>, as distributed by DuPont: flexible membrane flashing materials for window openings and penetrations.
  - 2. DuPont<sup>™</sup> FlexWrap<sup>™</sup> NF, as distributed by DuPont: flexible membrane flashing materials for window openings and penetrations.
  - 3. DuPont<sup>™</sup> StraightFlash<sup>™</sup>, as distributed by DuPont: straight flashing membrane materials for flashing windows and doors and sealing penetrations such as masonry ties, etc.

4. DuPont<sup>™</sup> StraightFlash<sup>™</sup> VF, as distributed by DuPont: dual-sided straight flashing membrane materials for brick mold and non-flanged windows and doors.

5. DuPont<sup>™</sup> Thru-Wall Surface Adhered Membrane with Integrated Drip Edge: Thru-Wall flashing membrane materials for flashing at changes in direction or elevation (shelf angles, foundations, etc.) and at transitions between different assembly materials.

6. Preformed Inside and Outside Corners and End Dams as distributed by DuPont: Preformed threedimensional shapes to complete the flashing system used in conjunction with DuPont<sup>™</sup> Thru-Wall Flashing.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

#### 3.2 INSTALLATION – WEATHER BARRIER

- A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.
- B. Install weather barrier prior to installation of windows and doors.
- C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.
- D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level.
- E. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.
- F. Window and Door Openings: Extend weather barrier completely over openings.
- G. Overlap weather barrier
  - 1. Exterior corners: minimum 12 inches.
  - 2. Seams: minimum 6 inches.
- H. Weather Barrier Attachment:
  - Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, space 12 -18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.
  - 2. Attach weather barrier to masonry. Secure using weather barrier manufacturer recommended fasteners, spaced 12-18 inches vertically on center and 24 inches maximum horizontally. Weather barrier may be temporarily attached to masonry using recommended adhesive, placed in vertical strips spaced 24 inches on center, when coordinated on the project site.
- I. Apply 4 inch by 7 inch piece of DuPont<sup>™</sup> StraightFlash<sup>™</sup> or weather barrier manufacturer approved alternate to weather barrier membrane prior to the installation cladding anchors.

#### 3.3 SEAMING

- A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.
- B. Seal any tears or cuts as recommended by weather barrier manufacturer.

# 3.4 OPENING PREPARATION (for use with non-flanged windows – all cladding types)

- A. Flush cut weather barrier at edge of sheathing around full perimeter of opening.
- B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

# 3.5 FLASHING (for use with non-flanged windows – all cladding types)

- A. Cut [7-inch] [9-inch] wide DuPont<sup>™</sup> FlexWrap<sup>™</sup> or DuPont<sup>™</sup> FlexWrap<sup>™</sup> NF a minimum of 12 inches longer than width of sill rough opening. Apply primer as required by manufacturer.
- B. Cover horizontal sill by aligning DuPont<sup>™</sup> FlexWrap<sup>™</sup> edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.
- C. Fan DuPont<sup>™</sup> FlexWrap<sup>™</sup> at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges. Mechanical fastening is not required for DuPont<sup>™</sup> FlexWrap<sup>™</sup> NF.
- D. Apply 9-inch wide strips of DuPont<sup>™</sup> StraightFlash<sup>™</sup> at jambs. Align flashing with interior edge of jamb framing. Start DuPont<sup>™</sup> StraightFlash<sup>™</sup> at head of opening and lap sill flashing down to the sill.
- E. Spray-apply primer to top 6 inches of jambs and exposed sheathing.
- F. Install DuPont<sup>™</sup> FlexWrap<sup>™</sup> DuPont<sup>™</sup> FlexWrap<sup>™</sup> NF at opening head using same installation procedures used at sill. Overlap jamb flashing a minimum of 2 inches.
- G. Coordinate flashing with window installation.
- H. On exterior, install backer-rod in joint between window frame and flashed rough framing. Apply sealant at jambs and head, leaving sill unsealed. Apply sealants in accordance with sealant manufacturer's instructions and ASTM C 1193.
- Position weather barrier head flap across head flashing. Adhere using 4-inch wide DuPont<sup>™</sup> StraightFlash<sup>™</sup> over the 45-degree seams.
- J. Tape top of window in accordance with manufacturer recommendations.
- K. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C 1193.

# 3.6 OPENING PREPARATION (for use with flanged windows)

- A. Cut weather barrier in an " $\underline{1}$ -cut" pattern. A modified  $\underline{1}$ -cut is also acceptable.
  - 1. Cut weather barrier horizontally along the bottom and top of the window opening.
  - 2. From the top center of the window opening, cut weather barrier vertically down to the sill.
  - 3. Fold side and bottom weather barrier flaps into window opening and fasten.
- B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

# 3.7 FLASHING (for use with flanged windows)

A. Cut [7-inch] [9-inch] wide DuPont<sup>™</sup> FlexWrap<sup>™</sup> or DuPont<sup>™</sup> FlexWrap<sup>™</sup> NF a minimum of 12 inches longer than width of sill rough opening.

B. Cover horizontal sill by aligning DuPont<sup>™</sup> FlexWrap<sup>™</sup> edge with inside edge of sill. Adhere to rough WEATHER BARRIER 07500-6

opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

- C. Fan DuPont<sup>™</sup> FlexWrap<sup>™</sup> at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges. Mechanical fastening is not required for DuPont<sup>™</sup> FlexWrap<sup>™</sup> NF.
- D. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.
- E. Install window according to manufacturer's instructions.
- F. Apply 4-inch wide strips of DuPont<sup>™</sup> StraightFlash<sup>™</sup> at jambs overlapping entire mounting flange. Extend jamb flashing 1-inch above top of rough opening and below bottom edge of sill flashing.
- G. Apply 4-inch wide strip of DuPont<sup>™</sup> StraightFlash<sup>™</sup> as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.
- H. Position weather barrier head flap across head flashing. Adhere using 4-inch wide DuPont<sup>™</sup> StraightFlash<sup>™</sup> over the 45-degree seams.
- I. Tape head flap in accordance with manufacturer recommendations.
- J. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C 1193.

# 3.8 THRU-WALL FLASHING INSTALLATION

- A. Apply primer per manufacturer's written instructions.
- B. Install preformed corners and end dams bedded in sealant in appropriate locations along wall.
- C. Starting at a corner, remove release sheet and apply membrane to primed surfaces in lengths of 8 to 10 feet.
- D. Extend membrane through wall and leave 1/4 inch minimum exposed to form drip edge.
- E. Roll flashing into place. Ensure continuous and direct contact with substrate.
- F. Lap ends and overlap preformed corners 4 inches minimum. Seal all laps with sealant.
- G. Trim exterior edge of membrane 1-inch and secure metal drip edge per manufacturer's written instructions.
- H. Terminate membrane on vertical wall. [Terminate into reglet, counterflashing or with termination bar.]
- I. Apply sealant bead at each termination.

# 3.9 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT BASE OF WALL

- A. Overlap thru-wall flashing with weather barrier by 6-inches.
- B. Mechanically fasten bottom of weather barrier through top of thru-wall flashing.
- C. Seal vertical and horizontal seams with tape or sealing membrane.

# 3.10 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT SHELF ANGLE

- A. Seal weather barrier to bottom of shelf angle with sealing membrane.
- B. Apply thru-wall flashing to top of shelf angle. Overlap thru-wall flashing with weather barrier by 6-inches.

# WEATHER BARRIER

C. Seal bottom of weather barrier to thru-wall flashing with tape or sealing membrane.

## 3.11 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT WINDOW HEAD

- A. Cut flap in weather barrier at window head.
- B. Prime exposed sheathing.
- C. Install lintel as required. Verify end dams extend 4 inches minimum beyond opening.
- D. Install end dams bedded in sealant.
- E. Adhere 2 inches minimum thru-wall flashing to wall sheathing. Overlap lintel with thru-wall flashing and extend <sup>1</sup>/<sub>4</sub> inch minimum beyond outside edge of lintel to form drip edge.
- F. Apply sealant along thru-wall flashing edges.
- G. Fold weather barrier flap back into place and tape bottom edge to thru-wall flashing.
- H. Tape diagonal cuts of weather barrier.
- I. Secure weather barrier flap with fasteners.

# 3.12 FIELD QUALITY CONTROL

A. Notify manufacturer's designated representative to obtain [required] periodic observations of weather barrier assembly installation.

# 3.14 PROTECTION

A. Protect installed weather barrier from damage.

# END OF SECTION

# SECTION 07901 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes joint sealants for the following locations:
  - 1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:
    - a. Control and expansion joints in cast-in-place concrete.
    - b. Control and expansion joints in unit masonry.
    - c. Joints between different materials listed above.
    - d. Perimeter joints between materials listed above and frames of doors and windows.
    - e. Control and expansion joints in ceiling and overhead surfaces.
    - f. Other joints as indicated.
  - 2. Exterior joints in horizontal traffic surfaces as indicated below:
    - a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
    - b. Joints between different materials listed above.
    - c. Other joints as indicated.
  - 3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints of exterior openings where indicated.
    - c. Joints between tops of non-load-bearing unit masonry walls and underside of cast-in-place concrete slabs and beams.
    - d. Tile control and expansion joints.
    - e. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
    - f. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    - g. Perimeter joints of toilet fixtures.
    - h. Other joints as indicated.
  - 4. Interior joints in horizontal traffic surfaces as indicated below:
    - a. Control and expansion joints in cast-in-place concrete slabs.
    - b. Control and expansion joints in tile flooring.

- c. Other joints as indicated.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 7 Section "Flashing and Sheet Metal" for sealing joints related to flashing and sheet metal for roofing.
  - 2. Division 7 Section "Firestopping" for through-penetration firestopping systems.
  - 3. Division 7 Section "Paving Joint Sealants" for sealing joints in portland cement concrete for pavements, walkways, and curbing.
  - 4. Division 8 "Glass and Glazing" for sealants used in glazing.
  - 5. Division 9 Section "Tile" for sealing tile joints.

## 1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

## 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data from manufacturers for each joint sealant product required.
  - 1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
- C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- D. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.
- F. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project names addresses, names of Architects and Owners, plus other information specified.
- G. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and

recommendations for primers and substrate preparation needed to obtain adhesion.

- H. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.
- I. Preconstruction field test reports indicating which products and joint preparation methods demonstrate acceptable adhesion to joint substrates.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers samples of materials that will contact or affect joint sealants for compatibility and adhesion testing as indicated below:
  - 1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
    - a. Perform tests under normal environmental conditions that will exist during actual installation.
  - 2. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
  - 3. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.
  - 4. Investigate materials failing compatibility or adhesion tests and obtain joint sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
- D. Product Testing: Provide comprehensive test data for each type of joint sealant based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24-month period preceding date of Contractor's submittal of test results to Architect.
  - 1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C 920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C 719), low-temperature flexibility, modulus of elasticity at 100 percent strain, effects of heat aging, and effects of accelerated weathering.
  - 2. Include test results performed on joint sealants after they have cured for 1 year.

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- E. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:
  - 1. Locate test joints where indicated or, if not indicated, as directed by Architect.
  - 2. Conduct field tests for each application indicated below:
    - a. Each type of elastomeric sealant and joint substrate indicated.
    - b. Each type of non-elastomeric sealant and joint substrate indicated.
  - 3. Notify Architect one week in advance of the dates and times when mock-ups will be erected.
  - 4. Test Method: Test joint sealants by hand pull method described below:
    - a. Install joint sealants in 5-feet joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealants to cure fully before testing.
    - b. Make knife cuts horizontally from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of joint and meeting horizontal cut at top of 2-inch cuts. Place a mark 1 inch from top of 2-inch piece.
    - c. Use fingers to grasp 2-inch piece of sealant just above 1-inch mark; pull firmly down at a 90-degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
  - 5. Report whether or not sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
  - 6. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.
- F. Field-Constructed Mock-Ups: Prior to installation of joint sealants, apply elastomeric sealants as follows to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution:
  - 1. Joints in field-constructed mock-ups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants specified in this Section.
- G. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of the Division 1 Section covering this activity.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
  - 2. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.
- 1.8 SEQUENCING AND SCHEDULING
  - A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

#### PART 2 - PRODUCTS

- 2.1 MATERIALS, GENERAL
  - A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - B. Colors: Provide color of exposed joint sealants to comply with the following:
    - 1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.
    - 2. Provide actual caulking samples for selection.

#### 2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing

elastomeric sealants that comply with ASTM C 920 and other requirements indicated on each Elastomeric Joint Sealant Data Sheet at end of this Section, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.

- B. One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide; intended for sealing interior joints with nonporous substrates and subject to in-service exposure to conditions of high humidity and temperature extremes.
- C. Multi-Part Nonsag Urethane Sealant for Use NT: Type M, Grade NS, Class 25, and complying with the following requirements for Uses:
  - 1. Uses NT, M, G, A, and, as applicable to joint substrates indicated, O.
- D. Multi-Part Pourable Urethane Sealant for Use T: Type M, Grade P, Class 25, and complying with the following requirements for Uses:
- E. Products: Subject to compliance with requirements, provide one of the following:
  - 1. One-Part Mildew-Resistant Silicone Sealant:
    - a. "Dow Corning 786"; Dow Corning Corp.
    - b. "SCS 1702 Sanitary"; General Electric Co.
    - c. "863 #345 White"; Pecora Corp.
    - d. "Proglaze White"; Tremco Corp.
    - e. "OmniPlus"; Sonneborn Building Products Div., Rexnord Chemical Products Inc.
  - 2. Multi-Part Nonsag Urethane Sealant for Use NT:
    - a. "Chem-Calk 500"; Bostik Construction Products Div.
    - b. "Vulkem 227"; Mameco International, Inc.
    - c. "Vulkem 922"; Mameco International, Inc.
    - d. "Dualthane"; W.R. Meadows.
    - e. "Dynatrol II"; Pecora Corp.
    - f. "Permapol RC-2"; Products Research & Chemical Corp.
    - g. "Sikaflex-2c NS"; Sika Corp.
    - h. "Sonolastic NP 2"; Sonneborn Building Products Div., Rexnord Chemical Products Inc.
    - i. "Dymeric"; Tremco Inc.
  - 3. Multi-Part, Pourable, Urethane Sealant for Use T:
    - a. "Chem-Calk 550"; Bostik Construction Product Div.
    - b. "NR-200 Urexpan"; Pecora Corp.
    - c. "Sonolastic Paving Joint Sealant"; Sonneborn Building Products Div., Rexnord Chemical Products Inc.
    - d. "THC-900"; Tremco Inc.

### 2.3 LATEX JOINT SEALANTS:

- A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior and on protected exterior locations involving joint movement of not more than plus or minus 5 percent.
  - 1. Acrylic-Emulsion Sealant:
    - a. "Chem-Calk 600"; Bostik Construction Products Div.
    - b. "AC-20"; Pecora Corp.
    - c. "Sonolac"; Sonneborn Building Products Div.; Rexnord Chemical Products, Inc.
    - d. "Tremco Acrylic Latex 834"; Tremco Inc.
- 2.4 FIRE-RESISTANT JOINT SEALERS:
  - A. General: Provide manufacturer's standard fire-stopping sealant, with accessory materials, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
  - B. Foamed-In-Place Fire-Stopping Sealant: Two-part, foamed-in-place, silicone sealant formulated for use in a through-penetration fire-stop system for filling openings around cables, conduit, pipes and similar penetrations through walls and floors.
  - C. One-Part Fire-Stopping Sealant: One part elastomeric sealant formulated for use in a through-penetration fire-stop system for sealing openings around cables, conduit, pipes and similar penetrations through walls and floors.
  - D. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
    - 1. Foamed-In-Place Fire-Stopping Sealant:
      - a. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
      - b. "Pensil 851"; General Electric Co.
    - 2. One-Part Fire-Stopping Sealant:
      - a. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
      - b. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
      - c. "RTV 7403"; General Electric Co.
      - d. "Fyre Putty"; Standard Oil Engineered Materials Co.

#### 2.5 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
  - 1. Open-cell polyurethane foam.
  - 2. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
  - 3. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf and tensile strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 gms/cc per ASTM C 1083.
- C. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F (-32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

#### 2.6 MISCELLANEOUS MATERIALS

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

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

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

## 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations of

ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

- D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
  - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
    - a. Do not leave gaps between ends of joint fillers.
    - b. Do not stretch, twist, puncture, or tear joint fillers.
    - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
  - 2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact 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.
  - 1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
  - 2. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
    - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.
  - 3. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

# 3.4 CLEANING

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

### 3.5 PROTECTION

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

END OF SECTION 07901

# SECTION 08111 - STANDARD STEEL DOORS AND FRAMES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following products manufactured in accordance with SDI Recommended Standards:
  - 1. Doors: Seamless, hollow or composite construction standard steel doors for interior and exterior locations.
  - 2. Frames: Pressed steel frames for doors, transoms, sidelights, mullions, interior glazed panels, and other interior and exterior openings of following type:
    - a. Welded unit type.
  - 3. Assemblies: Provide standard steel door and frame assemblies as required for the following:
    - a. Labeled and fire rated.
    - b. Thermal rated (insulated).
  - 4. Provide factory primed doors and frames to be field painted.
- B. Painting primed doors and frames is specified in Division 9 Section "Painting."
- C. Wood doors are specified in another Division 8 Section.
- D. Door hardware is specified in another Division 8 Section.
- E. Glass and Glazing are specified in another Division 8 Section.
- F. Building in of anchors and grouting of frames in masonry construction is specified in Division 4.

## 1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of door and frame specified, including details of

# STANDARD STEEL DOORS AND FRAMES

construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

- C. Shop drawings showing fabrication and installation of standard steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
  - 1. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
  - 2. Indicate coordinate of glazing frames and stops with glass and glazing requirements.
- D. Label Construction Certification: For door assemblies required to be fire-rated and exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.

## 1.4 QUALITY ASSURANCE

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications Standard Steel Doors and Frames" ANSI/SDI-100 and as herein specified. Provide Premium series equal to Steelcraft L-16 (1 3/4" thick) doors.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inches high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inches spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

## 2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide standard steel doors and frames by one of the following:

- 1. Standard Steel Doors and Frames:
  - a. Amweld Building Products, Inc.
  - b. Ceco Corp.
  - c. Copco Door Co.
  - d. Fenestra Corp.
  - e. Kewanee Corp.
  - f. Pioneer Industries.
  - g. Republic Builders Products.
  - h. Steelcraft Manufacturing Co.
  - i. Specialties, Inc.

#### 2.2 MATERIALS

- A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.
- B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.
- C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, or drawing quality, ASTM A 642, hot dipped galvanized in accordance with ASTM A 525, with A60 or G60 coating designation, mill phosphatized.
- D. Supports and Anchors: Fabricate of not less than 18-gage sheet steel; galvanized where used with galvanized frames.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A 153, Class C or D as applicable.
- F. Shop Applied Paint: Apply after fabrication.
  - 1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

#### 2.3 DOORS

- A. Provide metal doors of SDI grades and models specified below or as indicated on drawings or schedules:
  - 1. Interior Doors: ANSI/SDI-100, Grade II, heavy-duty, Model 3 or 4, minimum 18-gage cold-rolled sheet steel faces.
  - 2. Exterior Doors: ANSI/SDI-100, Grade III, extra heavy-duty, Model 4, minimum 16-gage galvanized steel faces.
- B. Door Louvers: Provide sightproof stationary louvers for doors where indicated, constructed of inverted V-shaped blades formed of 24-gage cold-rolled steel set into

minimum 20-gage steel frame. Provide insect screens on all exterior louvers.

#### 2.4 FRAMES

- A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16-gage cold-rolled steel.
  - 1. Fabricate frames with mitered, coped, or welded corners.
  - 2. Form exterior frames from 16-gage galvanized steel.
- B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.
- C. Plaster Guards: Provide minimum 26-gage steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

#### 2.5 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory- assembled before shipment, to assure proper assembly at project site. Comply with ANSI/SDI-100 requirements.
  - 1. Internal Construction: Manufacturer's standard honeycomb, polyurethane, polystyrene, unitized steel grid, vertical steel stiffeners, or rigid mineral fiber core with internal sound deadener on inside of face sheets where appropriate in accordance with SDI standards.
  - 2. Clearances: Not more than 1/8 inch at jambs and heads except between non-fire-rated pairs of doors not more than 1/4 inch. Not more than 3/4 inch at bottom.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel.
- C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel.
- E. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal insulating door and frame assemblies and tested in accordance with ASTM C 236 or ASTM C 976 on fully operable door assemblies.
  - 1. Unless otherwise indicated, provide thermal-rated assemblies with U factor of

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0.41 Btu/(hr x sq ft x deg F.) or better.

- F. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final Door Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 Series Specifications for door and frame preparation for hardware.
- G. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at project site.
- H. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames," published by Door and Hardware Institute.
- I. Shop Painting: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
  - 1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
  - 2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.
- J. Glazing Stops: Minimum 20 gage steel or .040-inch-thick aluminum.
  - 1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
  - 2. Provide screw applied removable glazing beads on inside of glass, louvers, and other panels in doors.

## PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
- B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions For Steel Frames," unless otherwise indicated.
  - 1. Except for frames located at existing concrete, masonry or drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
  - 2. In masonry construction, locate 3 wall anchors per jamb adjacent to hinge

location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry Tee anchors.

- 3. At existing concrete or masonry construction, provide 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb, set frames and secure to adjacent construction with bolts and masonry anchorage devices.
- 4. Install fire-rated frames in accordance with NFPA Standard No. 80.
- 5. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In closed steel stud partitions, attach wall anchors to studs with screws.
- C. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI-100.
  - 1. Install fire-rated doors with clearances as specified in NFPA Standard No. 80.

### 3.2 ADJUST AND CLEAN

- A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
- B. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.
- C. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION 08111

## SECTION 08212 - STILE AND RAIL WOOD DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Interior stile and rail wood doors.
  - 2. Priming stile and rail wood doors.
- B. Related Sections:
  - 1. Division 6 Section "Interior Architectural Woodwork" for requirements for veneers from the same flitches for both architectural woodwork and stile and rail wood doors.
  - 2. Division 6 Section "Paneling" for requirements for veneers from the same flitches for both wood paneling and stile and rail wood doors.
  - 3. Division 9 Section " Interior Painting" for field finishing stile and rail doors.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. Include details of construction.
  - 2. Include factory finishing specifications.
- B. LEED Submittals:
  - 1. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood used for stile and rail wood doors complies with forest certification requirements.
    - a. Include statement indicating costs for each certified wood product.
  - 2. Product Data for Credit EQ 4.4: For adhesives and composite wood materials, documentation indicating that products contain no urea formaldehyde.
- C. Shop Drawings: For stile and rail wood doors. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data, including the following:

- 1. Dimensions of doors for factory fitting.
- 2. Locations and dimensions of mortises and holes for hardware.
- D. Product Certificates: For each type of door, from manufacturer.
- E. Warranty: Sample of special warranty.

## 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Source Limitations: Obtain stile and rail wood doors from single manufacturer.
- 1.5 DELIVERY, STORAGE, AND HANDLING
  - A. Comply with manufacturer's written instructions and requirements of quality standard referenced in Part 2.
  - B. Package doors individually in opaque plastic bags or cardboard cartons.
  - C. Mark each door on top and bottom edge with opening number used on Shop Drawings.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship, or have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
  - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

- 2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
  - a. Interior Doors: Life of installation.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General: Use only materials that comply with referenced standards and other requirements specified.
  - 1. Assemble exterior doors and sidelites, including components, with wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.
  - 2. Assemble interior doors, frames, and sidelites, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.
- B. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea-formaldehyde resins.
- C. Panel Products: Any of the following:
  - 1. Particleboard made from wood particles, with binder containing no ureaformaldehyde resin, complying with ANSI A208.1, Grade M-2.
  - 2. Veneer core plywood, made with adhesive containing no urea-formaldehyde resin.

#### 2.2 INTERIOR STILE AND RAIL WOOD DOORS

- A. Interior Stile and Rail Wood Doors : Stock interior doors complying with WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," and with other requirements specified.
  - 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. Belentry Doors LLC.
    - b. International Door and Latch.
    - c. Jeld-Wen, Inc.
    - d. Karona, Inc.

- e. McPhillips Manufacturing Company.
- f. QSM Doors, Inc.
- g. Simpson Door Company.
- 2. Finish and Grade: Opaque and Standard.
- 3. Wood Species: Manufacturer's standard softwood species and cut.
- 4. Stile and Rail Construction: Edge-glued solid lumber.
- 5. Raised-Panel Construction: shaped, medium-density fiberboard.
- 6. Raised-Panel Thickness: Manufacturer's standard, but not less than that required by WDMA I.S.6 for design group indicated.
- 7. Molding Profile (Sticking): As selected by Architect from manufacturer's full range.
- 8. WDMA Design Group: 1-3/8 Interior Panel Doors.
  - a. Panel Design: SEE DRAWINGS.
- 9. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6 and grade specified. Include panel design number if applicable.
- B. Interior Stile and Rail Wood Doors: Custom interior doors complying with AWI's "Architectural Woodwork Quality Standards," and with other requirements specified.
  - 1. Stile and Rail Widths: Manufacturer's standard, but not less than the following:
    - a. Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm).
    - b. Bottom Rails: 9 inches (229 mm).

## 2.3 STILE AND RAIL WOOD DOOR FABRICATION

A. Fabricate stile and rail wood doors in sizes indicated for field fitting.

#### 2.4 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 9 Section " Interior Painting." Seal all four edges, edges of cutouts, and mortises with primer.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine doors and substrates, with Installer present, for suitable conditions where wood stile and rail doors will be installed.
  - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Field-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
  - 1. Clearances: Provide 1/8 inch (3 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3 mm from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6 mm) from bottom of door to top of threshold.
    - a. Comply with NFPA 80 for fire-rated doors.

#### 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or 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 08212

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#### SECTION 08411 SLIDING AUTOMATIC ENTRANCES

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 types of automatic entrances:
  - 1. Exterior and interior, single slide and bi-parting, sliding automatic entrances.
  - 2. Sliding and fixed panels shall be all glass with top and bottom rail.
- B. Related Sections:
  - 1. Division 7 Sections for caulking to the extent not specified in this section.
  - 2. Division 8 Section "Aluminum-Framed Entrances and Storefronts" for entrances furnished and installed separately in Division 8 Section.
  - 3. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
  - 4. Division 26 Sections for electrical connections provided separately including conduit and wiring for power to sliding automatic entrances.

#### 1.3 REFERENCES

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- B. Underwriters Laboratories (UL):
  - 1. UL 325 Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
- C. American National Standards Institute (ANSI) / Builders' Hardware Manufacturers Association (BHMA):
  - 1. ANSI/BHMA A156.10: Standard for Power Operated Pedestrian Doors.
  - 2. ANSI/BHMA A156.5: Standard for Auxiliary Locks and Associated Products
  - 3. ANSI Z97.1: Standard for Safety Glazing Materials Used In Buildings Safety Performance Specifications And Methods Of Test.
- D. Consumer Product Safety Commission (CPSC):
  - 1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials
- E. American Society for Testing and Materials (ASTM):
  - 1. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - 2. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- F. American Association of Automatic Door Manufacturers (AAADM):
- G. National Fire Protection Association (NFPA):
  - 1. NFPA 101 Life Safety Code.

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- 2. NFPA 70 National Electric Code.
- H. International Code Council (ICC):1. IBC: International Building Code
- I. Building Officials and Code Administrators International (BOCA), 1999:
- J. International Organization for Standardization (ISO): 1. ISO 9001 - Quality Management Systems
- K. National Association of Architectural Metal Manufacturers (NAAMM):
  1. Metal Finishes Manual for Architectural and Metal Products.
- L. American Architectural Manufacturers Association (AAMA):
  - 1. [AAMA 606.1 Integral Color Anodic Finishes for Architectural Aluminum.]
  - 2. [AAMA 607.1 Clear Anodic Finishes for Architectural Aluminum.]

#### 1.4

#### 1.5 DEFINITIONS

- A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.
- B. Safety Device: Device that prevents a door from opening or closing, as appropriate.
- 1.6 PERFORMANCE REQUIREMENTS
  - A. General: Provide automatic entrance door assemblies capable of withstanding loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
  - B. Thermal Movements: Provide automatic entrances that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
    - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
  - C. Operating Range: Minus 30 deg F (Minus 34 deg C) to 130 deg F (54 deg C).
  - D. Opening-Force Requirements for Egress Doors: Force shall be adjustable; but, not more than 50 lbf (222 N) required to manually set swinging egress door panel(s) in motion.
  - E. Closing-Force Requirements: Not more than 30 lbf (133 N) required to prevent door from closing.

#### 1.7 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.
- C. Color Samples for selection of factory-applied color finishes.

#### SLIDING AUTOMATIC ENTRANCES

- D. Closeout Submittals:
  - 1. Owner's Manual.
  - 2. Warranties.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer with a manufacturing facility certified under ISO 9001.
- C. Manufacturer shall have in place a national service dispatch center providing 24 hours a day, 7 days a week, emergency call back service.
- D. Certifications: Automatic sliding door systems shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:
  - 1. ANSI/BHMA A156.10.
  - 2. NFPA 101.
  - 3. UL 325 listed.
  - 4. IBC 2009
  - 5. BOCA
- E. Source Limitations: Obtain automatic entrance door assemblies through one source from a single manufacturer.
- F. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of automatic entrance door assemblies and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- G. 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.
- H. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

#### 1.9 PROJECT CONDITIONS

- A. Field Measurements: General Contractor shall verify openings to receive automatic entrance door assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.
- C. Other trades: General Contractor shall advise of any inadequate conditions or equipment.

#### 1.10 COORDINATION

A. Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.
B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies.

#### 1.11 WARRANTY

- A. Automatic Entrances shall be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.
- B. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.
- C. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

#### PART 2 - PRODUCTS

#### 2.1 AUTOMATIC ENTRANCES

A. Manufacturer: Stanley Access Technologies; Dura-Glide<sup>™</sup> **2000** All Glass Series sliding automatic entrances.

#### 2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  - 1. Headers, stiles, rails, and frames: 6063-T6.
  - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
  - 3. Sheet and Plate: ASTM B 209.
- B. Sealants and Joint Fillers: Performed under Division 7 Section "Joint Sealants".
- 2.3 AUTOMATIC ENTRANCE DOOR ASSEMBLIES
  - A. General: Provide manufacturer's standard automatic entrance door assemblies including doors, sidelights, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.

### Specifier Note: Modify paragraph below to suit project requirements.

- Select "sliding leaf only" for fixed sidelight applications; Series 2000.
- Select "sliding leaves and sidelights" for full breakout applications; Series 3000. Coordinate with selections above.
  - B. Sliding Automatic Entrances:
    - 1. Single Slide Entrances:
      - a. Configuration: One sliding leaf and one full sidelight.
      - b. Traffic Pattern: Two-way.
      - c. Emergency Breakaway Capability: Sliding leaf only Mounting: Between jambs.
      - d. Mounting: Between jambs.

#### 2.4 COMPONENTS

A. Framing Members: Manufacturer's standard extruded aluminum reinforced as required to support imposed loads.

3.

- 1. Nominal Size: **1 3/4 inch by 4 1/2 inch**
- 2. Concealed Fastening: Framing shall incorporate a concealed fastening pocket, and continuous flush insert cover, extending full length of each framing member.
- B. Glass Panels and Rails: Manufacturer's standard 1 <sup>3</sup>/<sub>4</sub> inch (45 mm) thick extruded-aluminum tubular rail members. Rail members to be specifically designed by automatic entrance manufacturer for use with glass panel automatic entrance systems. Fasten rails to glass panels by mechanical clamp; adhesive systems not acceptable.
  - 1. Top Rail: 6 1/8 inch (156 mm) nominal height.
  - 2. Bottom Rail: 4 inch (102 mm nominal height.
    - Glazing: Provide glazing for sliding automatic entrances as follows:
      - a. Provide safety glass complying with ANSI Z97.1 and CPSC 16 CFR 1201 for Category II materials.
      - b. Safety Glass: 1/2 inch (12 mm) clear, fully tempered, with polished edges, in all panels.
- C. Headers: Fabricated from extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
  - 1. Mounting: Concealed, with one side of header flush with framing.
  - 2. Capacity: Capable of supporting up to 220 lb (100 kg) per panel, up to four panels, over spans up to 14 feet (4.3 m) without intermediate supports.
- D. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment of at least 1/8 inch (3 mm); consisting of urethane with precision steel lubricated ball-bearing wheels, operating on a continuous roller track. Support panels from carrier assembly by load wheels and anti-riser wheels with factory adjusted cantilever and pivot assembly. Minimum two ball-bearing load wheels and two anti-rise rollers for each active leaf. Minimum load wheel diameter shall be 2 1/2 inch (64 mm); minimum anti-rise roller diameter shall be 2 inch (51 mm).
- E. Thresholds: Manufacturer's standard thresholds as indicated below:
  - 1. Standard tapered extrusion, double bevel, under sidelights; no threshold under sliding opening.
  - 2. All thresholds to conform to details and requirements for code compliance.
- F. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding fasteners and accessories compatible with adjacent materials.
- G. Signage: Provide signage in accordance with ANSI/BHMA A156.10.

#### 2.5 DOOR OPERATORS

- A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, operation under normal traffic load for type of occupancy indicated.
- B. Electromechanical Operators: Self-contained overhead unit powered by a minimum of 1/4 horsepower, permanent-magnet DC motor with gear reduction drive, microprocessor controller; and encoder.
  - 1. Operation: Power opening and power closing.
  - 2. Features:
    - a. Adjustable opening and closing speeds.
    - b. Adjustable back-check and latching.

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- c. Adjustable braking.
- d. Adjustable hold-open time between 0 and 30 seconds.
- e. Obstruction recycle.
- f. On/Off switch to control electric power to operator.
- g. Energy conservation switch that reduces door-opening width.
- h. Closed loop speed control with active braking and acceleration.
- i. Adjustable obstruction recycle time delay.
- j. Self adjusting stop position.
- k. Self adjusting closing compression force.
- I. Onboard sensor power supply.
- m. Onboard sensor monitoring.
- n. Optional Switch to open/Switch to close operation.
- 3. Mounting: Concealed.
- 4. Drive System: Synchronous belt type.
- C. Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 5 amps.

#### 2.6 ELECTRICAL CONTROLS

- A. Electrical Control System: Electrical control system shall include a microprocessor controller and position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed. Systems utilizing external magnets and magnetic switches are not acceptable.
- B. Performance Data: The microprocessor shall collect and store performance data as follows:
  - 1. Counter: A non-resettable counter to track operating cycles.
  - 2. Event Reporting: Unit shall include event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
  - 3. LED Display: Display presenting the current operating state of the controller.
- C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
  - 1. Automatic Reset Upon Power Up.
  - 2. Main Fuse Protection.
  - 3. Electronic Surge Protection.
  - 4. Internal Power Supply Protection.
  - 5. Resetable sensor supply fuse protection.
  - 6. Motor Protection, over-current protection.
- D. Soft Start/Stop: A "soft-start" "soft-stop" motor driving circuit shall be provided for smooth normal opening and recycling.
- E. Obstruction Recycle: Provide system to recycle the sliding panels when an obstruction is encountered during the closing cycle. If an obstruction is detected, the system shall search for that object on the next closing cycle by reducing door closing speed prior to the previously encountered obstruction location, and will continue to close in check speed until doors are fully closed, at which time the doors will reset to normal speed. If obstruction is encountered again, the door will come to a full stop. The doors shall remain stopped until obstruction is removed and operate signal is given, resetting the door to normal operation.
- F. Programmable Controller: Microprocessor controller shall be programmable and shall be designed for connection to a local configuration tool. Local configuration tool shall be a software driven handheld interface. The following parameters may be adjusted via the configuration tool.
  - 1. Operating speeds and forces as required to meet ANSI/BHMA A156.10.

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- 2. Adjustable and variable features as specified in 2.5, B., 2.
- 3. Reduced opening position.
- 4. Fail Safe/Secure control.
- 5. Firmware update.
- 6. Trouble Shooting
  - a. I/O Status.
  - b. Electrical component monitoring including parameter summary.
- 7. Software for local configuration tool shall be available as a free download from the sliding automatic entrance manufacturer's internet site. Software shall be compatible with the following operating system platforms: Palm®, Android®, and Windows Mobile®.

### 2.7 ACTIVATION AND SAFETY DEVICES

- A. Motion Sensors: Motion sensors shall be mounted on each side of door header to detect pedestrians in the activating zone, and to provide a signal to open doors in accordance with ANSI/BHMA A156.10. Units shall be programmable for bi-directional or uni-directional operation and shall incorporate K-band microwave frequency to detect all motion in both directions.
- B. Presence Sensors: Presence sensors shall be provided to sense people or objects in the threshold safety zone in accordance with ANSI/BHMA A156.10. Units shall be self-contained, fully adjustable, and shall function accordingly with motion sensors provided. The sensor shall be enabled simultaneously with the door-opening signal and shall emit an elliptical shaped infrared presence zone, centered on the doorway threshold line. Presence sensors shall be capable of selectively retuning to adjust for objects which may enter the safety zone; tuning out, or disregarding, the presence of small nuisance objects and not tuning out large objects regardless of the time the object is present in the safety zone. The door shall close only after all sensors detect a clear surveillance field.
- C. Photoelectric Beams: In addition to the threshold sensor include a minimum of two (2) doorway holding beams. Photoelectric beams shall be pulsed infrared type, including sender receiver assemblies for recessed mounting. Beams shall be monitored by electrical controls for faults and shall fail safe.

### 2.8 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated.
- B. Emergency Breakaway Feature: Provide release hardware that allows panel(s) to swing out in direction of egress to full 90 degrees from any position in sliding mode. Maximum force to open panel shall be 50 lbf (222 N) according to ANSI/BHMA A156.10. Interrupt powered operation of panel operator while in breakaway mode.
  - 1. Emergency breakaway feature shall include at least one adjustable detent device mounted in the top of each breakaway panel to control panel breakaway force.
- C. Deadlocks: Manufacturer's standard deadbolt operated by exterior cylinder and interior thumb turn; with minimum 1 inch (25 mm) long throw bolt; ANSI/BHMA A156.5, Grade 1.
  - 1. Cylinders: Provide lock cylinders by BEST Access Systems, with core and key.
  - 2. Locking: Provide independent locks incorporated into the bottom rails of the sliding panel that, when engaged, automatically extend flush bolts into the threshold.
- D. Control Switch: Provide manufacturer's standard header mounted rocker switches and door position switch to allow for full control of the automatic entrance door. Controls to include, but are not limited to:
  - 1. One-way traffic
  - 2. Reduced Opening

#### 3. Open/Closed/Automatic

- E. Power Switch: Sliding automatic entrances shall be equipped with a two position On/Off rocker switch to control power to the door.
- F. Sliding Weather Stripping: Manufacturer's standard replaceable components complying with AAMA 701; made of flexible PVC.
- G. Weather Sweeps: Manufacturer's standard adjustable nylon brush sweep mounted to underside of panel bottom.

#### 2.9 FABRICATION

- A. General: Factory fabricates automatic entrance door assembly components to designs, sizes, and thickness indicated and to comply with indicated standards.
  - 1. Form aluminum shapes before finishing.
  - 2. Use concealed fasteners to greatest extent possible.
    - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
    - b. Reinforce members as required to receive fastener threads.
- B. Framing: Provide automatic entrances as prefabricated assemblies.
  - 1. Fabricate tubular and channel frame assemblies with manufacturer's standard mechanical or welded joints. Provide sub-frames and reinforcement as required for a complete system to support required loads.
  - 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
  - 3. Form profiles that are sharp, straight, and free of defects or deformations.
  - 4. Prepare components to receive concealed fasteners and anchor and connection devices.
  - 5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated.
- F. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site.

#### 2.10 ALUMINUM FINISHES

- A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.
- 2.11 Multi-coat Fluoropolymer painted finishes.
  - 1. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.]

#### PART 3 - EXECUTION

#### 3.1 INSPECTION

A. Examine conditions for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. General: Do not install damaged components. Fit frame joints to produce joints free of burrs and distortion. Rigidly secure non-movement joints.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
  - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
  - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
- C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 16 Sections.
- D. Glazing: Performed under Division 8 Section "Glazing" in accordance with sliding automatic entrance manufacturer's instructions.
- E. Sealants: Comply with requirements specified in Division7 Section "Joint Sealants".
- 3.3 FIELD QUALITY CONTROL
  - A. Testing Services: Factory Trained Installer shall test and inspect each automatic entrance door to determine compliance of installed systems with applicable ANSI standards.
- 3.4 ADJUSTING
  - A. Adjust door operators, controls, and hardware for smooth and safe operation, for tight closure, and complying with requirements in ANSI/BHMA A156.10.
- 3.5 CLEANING AND PROTECTION
  - A. Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish. Comply with requirements in Division 8 Section "Glazing", for cleaning and maintaining glass.

END OF SECTION 08411

### SECTION 08550 ALUMINUM-CLAD WOOD WINDOWS

#### PART 1 GENERAL

- 1.1 SECTION INCLUDES
  - A. Aluminum-Clad Wood Windows: (Premium Siteline Series)
    - 1. Radius and geometric windows. (Premium Siteline Series)

#### 1.2 REFERENCES

- A. American Architectural Manufacturer Association (AAMA):
  - 1. AAMA 2603: Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  - 2. ANSI/AAMA/NWWDA 101/I.S.2 /NAFS Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.
- B. ASTM International (ASTM):
  - 1. ASTM E 283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - 2. ASTM E 330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- C. National Fenestration Rating Council (NFRC):
  - 1. NFRC 100 Procedure for Determining Fenestration Thermal Properties.
  - 2. NFRC 200 Solar Heat Gain Coefficient and Visible Transmittance.
- D. Window and Door Manufacturers Association (WDMA): WDMA I.S.4; Water Repellent Preservative Non-Pressure treatment for Millwork.

#### 1.3 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Shop Drawings: Submit shop drawings indicating details of construction, flashings and relationship with adjacent construction.
- D. Selection Samples: For each factory-finished product specified, two complete sets of color chips representing manufacturer's full range of available finishes.
- E. Verification Samples: For each factory-finished product specified, two samples, minimum size 6 inches (150 mm) square, representing actual finishes.
- F. Quality Assurance Submittals:
- G. Closeout Submittals: Refer to Section 01700 Closeout Submittals.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 2 years installing similar assemblies.
- B. Pre-installation Meeting: Conduct pre-installation meeting on-site two weeks prior to commencement of installation.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.
- B. Deliver and store assembly materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact. Protect from damage.

#### 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 WARRANTY

- A. Manufacturer's Standard Warranty: Assemblies will be free from defects in materials and workmanship from the date of Substantial Completion for the time periods indicated below:
  - 1. Window Units: 20 years.
  - 2. Clad Finishes: 20 years against peeling, checking, cracking caulk or color change.
  - 3. Glazing:
    - a. Insulated Glass: 20 years against seal breakage.

#### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: JELD-WEN, Inc.; PO Box 1329, Klamath Falls, OR 97601. ASD. Toll Free Tel: (800) 535-3936. Tel: (541) 882-3451. Fax: (541) 851-4333. Email: architectural\_inquiries@jeld-wen.com. Web: http://www.jeld-wen.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

#### 2.2 ALUMINUM-CLAD WOOD WINDOWS - GENERAL

- A. Design Requirements:
  - 1. Compliance: Provide assemblies capable of complying with requirements indicated, based on testing manufacturer's windows that are representative of those specified.
  - 2. NFRC Requirements: Provide assemblies complying with the following total window ratings:
    - a. U-Factor: \_\_\_.32\_\_\_\_ in accordance with NFRC 100.
    - b. Solar Heat Gain Coefficient (SHGC): \_\_.33\_\_\_\_ in accordance with NFRC 200.
    - c. Visible Transmittance (VT): \_\_\_\_NA\_\_\_\_ in accordance with NFRC 200.
- B. Installation Accessories:
  - 1. Flashing: Refer to Section 07600 Flashing and Sheet Metal.

- 2. Sealants: Refer to Section 07901 Joint Sealants.
- 3. Sealants: Provide manufacturer recommended sealants to maintain watertight conditions.
- C. Materials:
  - 1. Exterior Cladding: Roll formed and extruded aluminum.
  - 2. Exterior Wood: Western Pine, preservative treated with AuraLast by JELD-WEN, Inc. in accordance with WDMA I.S.4.
  - 3. Interior Wood:
    - a. Material: Standard, Western Pine.
- D. Finishes:
  - 1. Interior Finishes for Windows:
    - a. Finish: Standard, unfinished.
  - Exterior Finishes for Windows: 3-coat finish in accordance with AAMA 2603.
    a. Finish: Brilliant White.
- 2.3 ALUMINUM-CLAD WOOD WINDOW ASSEMBLIES (PREMIUM SITELINE SERIES)
  - A. Basis of Design: Premium Siteline Series aluminum-clad wood windows assemblies as manufactured by JELD-WEN, Inc.
    - 1. Window Type: Radius and geometric windows.
  - B. Window Fabrication:
    - 1. Window Type: Radius and geometric windows.
      - a. Frame: Head corner joints mechanically fastened over silicone injected nylon corner key. Sill corner joints sealed with foam gasket and screw boss construction.
      - b. Glass: Mounted using silicone glazing compound and secured with interior applied profiled wood stops.
  - C. Frames:
    - 1. Material: Select kiln-dried pine AuraLast treated wood.
    - 2. Jamb Width: 4-9/16 inches (116 mm).
    - 3. Cladding: 0.050 inch (1.27 mm) extruded aluminum.
  - D. Sashes: Select kiln-dried pine AuraLast treated wood.
    - 1. Cladding: 0.050 inch (1.27 mm) extruded aluminum.
  - E. Exterior Trim:
    - 1. Nailing Fin and Drip Cap: Integral extruded aluminum on all four sides of frame.
    - 2. Casing: Extruded aluminum brickmould.
    - 3. Frame Expanders: As Required
  - F. In-Sash Interior Radius Trim:
    - 1. Material: Pine.
  - G. Factory Applied Extension Jambs: Provide on four sides of frame interior, 21/32 inch (16.7 mm) up to 12 inches (304.8 mm).
  - H. Weatherstripping:
    - 1. For Radius and Geometric Windows: Flexible hinged leaf applied to top of sash and thermoplastic rubber bulb at full perimeter of frame.
      - a. Jamb Liner Color: Standard, ivory.
  - I. Glazing for Windows:

- 1. Strength: Standard, annealed glass.
- 2. Glazing Type: Insulated glass.
  - a. Description: Two panes of glass utilizing continuous roll formed stainless steel spacer and dual seal sealants.
  - b. Overall Nominal Thickness: 3/4 inch (19 mm).
  - c. capillary Glass Type: Standard, Type 1 Clear.
  - d. Coating on No 2 Surface: Standard, Low-E.
  - e. Air Space: Provide optional air-filled airspace.
- J. Grilles:
  - 1. Type: Simulated Divided Lites (SDL).
    - Internal Shadow Bar: Standard, Whitefinish.
      - 1) Width: Match exterior muntin.
  - 2. Type: Grilles Between the Glass (GBG).
    - a. Material: Made of roll formed aluminum suspended within the air cavity.
    - b. Profile: Flat.
    - c. Pattern: As scheduled and indicated on Drawings.
    - d. Finish: Brilliant White.

### PART 3 EXECUTION

#### 3.1 EXAMINATION AND PREPARATION

a.

- A. Inspect and prepare openings and substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions.
  - 1. Inspect assembly components prior to installation.
  - 2. Verify rough opening conditions are within recommended tolerances.
  - 3. Form sheet metal sill pan in accordance with manufacturer's recommendations.
  - 4. Prepare assembly components for installation in accordance with manufacturer's recommendations.
- B. Do not proceed with installation until openings and substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.
- C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

### 3.2 INSTALLATION

- A. Install assemblies in accordance with manufacturer's installation guidelines and recommendations including the following.
- B. Installation of Windows With Nailing Fins: Insert windows into rough opening.
  - 1. Shim side jambs straight.
  - 2. Inspect window for square, level and plumb.
  - 3. Fasten window through nailing fins around entire window.
  - 4. Test and adjust for smooth operation of window.
  - 5. Set all nails below wood surface.

#### 3.3 FIELD QUALITY CONTROL

A. Manufacturers' Field Services: Field inspections.

### 3.4 CLEANING AND PROTECTION

- A. Clean the exterior surface and glass with mild soap and water.
- B. Protect installed windows from damage.
- C. Remove and dispose of protective film from glass; touch-up, repair or replace damaged components and assemblies before Substantial Completion.

END OF SECTION

# SECTION 08710 - DOOR HARDWARE

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hinges.
  - 2. Pivots.
  - 3. Spring hinges.
  - 4. Key control system.
  - 5. Lock cylinders and keys.
  - 6. Lock and latch sets.
  - 7. Bolts.
  - 8. Exit devices.
  - 9. Push/pull units.
  - 10. Closers. Including automatic electric closers.
  - 11. Overhead holders.
  - 12. Miscellaneous door control devices.
  - 13. Door trim units.
  - 14. Protection plates.
  - 15. Weatherstripping for exterior doors.
  - 16. Astragals or meeting seals on pairs of doors.
  - 17. Thresholds.
  - 18. Removable Mullions.
  - 19. Interior Signage.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 6 Section "Interior Architectural Woodwork" for cabinet hardware.
  - 2. Division 8 Section "Standard Steel Doors and Frames" for silencers integral with hollow metal frames.
- C. Products furnished but not installed under this Section include:
  - 1. Hardware for entrance doors.
  - 2. Final replacement cores and keys to be installed by Owner.

### 1.3 HARDWARE

- A. Door hardware supplier's responsibilities shall be as follows:
  - 1. Submittals: Submit through Contractor required product data, final hardware schedule, separate keying schedule, and samples as specified in this Section, unless otherwise indicated.
  - 2. Construction Schedule: Inform Contractor promptly of estimated times and dates that will be required to process submittals, to furnish templates, to deliver hardware, and to perform other work associated with furnishing door hardware for purposes of including this data in construction schedule. Comply with this schedule.
  - 3. Coordination and Templates: Assist Contractor as required to coordinate hardware with other work in respect to both fabrication and installation. Furnish Contractor with templates and deliver hardware to proper locations.
  - 4. Product Handling: Package, identify, deliver, and inventory door hardware specified in this Section.
  - 5. Discrepancies: Based on requirements indicated in Contract Documents in effect at time of door hardware selection, furnish types, finishes, and quantities of door hardware, including fasteners, and Owner's maintenance tools required to comply with specified requirements and as needed to install and maintain hardware. Furnish or replace any items of door hardware resulting from shortages and incorrect items at no cost to the Owner or Contractor. Obtain signed receipts from Contractor for all delivered materials.
- B. Contractor's responsibilities shall be as follows:
  - 1. Submittals: Coordinate and process submittals for door hardware in same manner as submittals for other work.
  - 2. Construction Schedule: Cooperate with door hardware supplier in establishing scheduled dates for submittals and delivery of templates and door hardware. Incorporate in construction schedule the times and dates related to furnishing hardware by door hardware supplier.
  - 3. Coordination: Coordinate door hardware with other Work. Furnish hardware supplier or manufacturer with shop drawings of other work where required or requested. Verify completeness and suitability of hardware with supplier.
  - 4. Product Handling: Provide secure lock-up for hardware delivered to the site. Inventory hardware jointly with representative of hardware supplier and issue signed receipts for all delivered materials.
  - 5, Installation Information: The general types and approximate quantities of hardware required for this Project are indicated at the end of this Section in order to establish Contractor's costs for installation and other work not included in

#### allowance.

### 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data including manufacturers' 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.
- C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
    - a. Type, style, function, size, and finish of each hardware item.
    - b. Name and manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
    - e. Explanation of all abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for hardware.
    - g. Door and frame sizes and materials.
    - h. Keying information.
  - 2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
  - 3. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- D. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

### 1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.

### 1.6 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware

## DOOR HARDWARE

schedule, and include basic installation instructions with each item or package.

- B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).
- E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

### 1.7 MAINTENANCE

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

## PART 2 - PRODUCTS

### 2.1 DOOR HARDWARE

A. Basis-of-Design Product: Product named for each door hardware item indicated in Door Hardware sets establishes the basis of desigh. Provide either the named product or a comparable product.

B. Scheduled Door Hardware: Provide door hardware according to Door Hardware sets of Part 3 of this section.

### 2.2 MATERIALS AND FABRICATION

- A. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.
- B. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

C. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. 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 as closely as possible including "prepared for paint" surfaces to receive painted finish.

## 2.3 HINGES, BUTTS, AND PIVOTS

- A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Screws: Provide Phillips flat-head screws complying with the following requirements:
  - 1. For metal doors and frames install machine screws into drilled and tapped holes.
  - 2. For wood doors and frames install wood screws.
  - 3. For fire-rated wood doors install #12 x 1-1/4-inch, threaded-to-the-head steel wood screws.
  - 4. Finish screw heads to match surface of hinges or pivots.
- C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
  - 5. Out-Swing Exterior Doors: Nonremovable pins.
  - 6. Out-Swing Corridor Doors with Locks: Nonremovable pins.
  - 7. Interior Doors: Nonrising pins.
- D. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges per door leaf for doors 90 inches or less in height and one additional hinge for each 30 inches of additional height.

### 2.4 LOCK CYLINDERS AND KEYING

- A. Review the keying system with the Owner and provide the type required (master, grandmaster or great-grandmaster), either new or integrated with Owner's existing system.
- B. Equip locks with manufacturer's special 6-pin tumbler cylinder with construction masterkey feature that permits voiding of construction keys without cylinder removal.
  - 1. Furnish final cores and keys for installation by Owner.
- C. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.
- D. Comply with Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with

a group of related locks.

- 1. Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."
- E. Key Material: Provide keys of nickel silver only.
- F. Key Quantity: Furnish 2 change keys for each lock and 10 master keys for each master system.
  - 1. Deliver keys to Owner.

### 2.5 LOCKS, LATCHES, AND BOLTS

- A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.
  - 1. Provide flat lip strikes for locks with 3-piece, antifriction latchbolts as recommended by manufacturer.
  - 2. Provide extra long strike lips for locks used on frames with applied wood casing trim.
  - 3. Provide recess type top strikes for bolts locking into head frames, unless otherwise indicated.
  - 4. Provide dust-proof strikes for foot bolts, except where special threshold construction provides nonrecessed strike for bolt.
  - 5. Provide roller type strikes where recommended by manufacturer of the latch and lock units.
- B. Lock Throw: Provide 5/8-inch minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
  - 1. Provide 1/2-inch minimum throw of latch for other bored and preassembled types of locks and 3/4-inch minimum throw of latch for mortise locks. Provide 1-inch minimum throw for all dead bolts.
- C. Flush Bolt Heads: Minimum of 1/2-inch-diameter rods of brass, bronze, or stainless steel with minimum 12-inch-long rod for doors up to 7'-0" in height. Provide longer rods as necessary for doors exceeding 7'-0" in height.
- D. Exit Device Dogging: Except on fire-rated doors where closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to keep the latch bolt retracted, when engaged.

2.6 PUSH/PULL UNITS

A. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for

## DOOR HARDWARE

installation, thru-bolted for matched pairs but not for single units.

## 2.7 CLOSERS AND DOOR CONTROL DEVICES

- A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.
  - 1. Where parallel arms are indicated for closers, provide closer unit one size larger than recommended for use with standard arms.
- B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A117.1 provisions for door opening force and delayed action closing.
- C. Combination Door Closers and Holders: Provide units designed to hold door in open position under normal usage and to release and close door automatically under fire conditions. Incorporate an integral electromagnetic holder mechanism designed for use with UL listed fire detectors, provided with normally closed switching contacts.
  - 1. Provide integral smoke detector device in combination door closers and holders complying with UL 228.
- D. Flush Floor Plates: Provide finished metal flush floor plates for floor closers except where thresholds are indicated and cover plate is specified to be an integral part of threshold. Finish floor plate to match hardware sets, unless otherwise indicated.
- E. Recessed Floor Plates: Provide recessed floor plates where no thresholds are indicated and floor closers are located in an area of resilient flooring. Recess plates to receive an insert of the floor finish material of the normal thickness as indicated. Provide extended spindle on closer as may be necessary to accommodate thickness of floor finish.
- F. Provide grey resilient parts for exposed bumpers.

### 2.8 DOOR TRIM UNITS

- A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
- B. Fabricate edge trim of stainless steel to fit door thickness in standard lengths or to match height of protection plates.
- C. Fabricate protection plates not more than 1-1/2 inches less than door width on hinge side and not more than 1/2 inch less than door width on pull side by height indicated.
  - 1. Metal Plates: Stainless steel, 0.050 inch (U.S. 18 gage).
  - 2. Metal Plates: Brass or bronze, 0.062 inch (U.S. 16 gage).

### 2.9 WEATHERSTRIPPING AND SEALS

- A. General: Provide continuous weatherstripping on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
- B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
- C. Weatherstripping at Jambs and Heads: Provide bumper-type resilient insert and metal retainer strips, surface applied unless shown as mortised or semimortised, and of following metal, finish, and resilient bumper material:
  - 1. Extruded aluminum with color anodized finish as selected from manufacturer's standard color range, 0.062-inch minimum thickness of main walls and flanges.
  - 2. Sponge neoprene conforming to MIL R 6130, Class II (Closed Cell).
    - a. Grade A (30 deg F to 150 deg F, oil-resistant and self-extinguishing).
  - Expanded neoprene: Cellular rubber conforming to ASTM D 1056 Type 2 (closed-cell); Class B (low-swell, oil-resistant); Grade 2 (compression-deflection of 5 - 9 psi); and self-extinguishing in following size:
    - a. 3/16 inch x 5/8 inch.
  - 4. Solid neoprene conforming to MIL R 6855, Class II, Grade 40.
    - a. Flexible, hollow bulb or loop insert.
  - 5. Flexible vinyl hollow bulb or loop insert.
  - 6. Brush pile insert of polypropylene or nylon woven pile and aluminum strip backing complying with AAMA 701.2.
- D. Weatherstripping at Door Bottoms: Provide threshold consisting of contact-type resilient insert and metal housing of design and size shown and of following metal, finish, and resilient seal strip:
  - 1. Solid neoprene wiper or sweep seal complying with MIL R 6855, Class II, Grade 40.

### 2.10THRESHOLDS

- A. General: Except as otherwise indicated, provide standard metal threshold unit of type, size, and profile as shown or scheduled.
- B. Exterior Hinged or Pivoted Doors: Provide units not less than 4 inches wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames, and as follows:

- 1. For in-swinging doors provide units with interlocking lip and interior drain channel; include hook on bottom edge of door and drain pan.
- 2. For out-swinging doors provide rabbeted type units with replaceable weatherstrip insert in stop.

### 2.11HARDWARE FINISHES

- A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).
- B. Provide finishes that match those established by BHMA or, if none established, match the Architect's sample.
- C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer."
- E. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

### PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
  - 1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
  - 2. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved. Note: Install screws with hand (not power) screwdriver.
- C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units that are not factory prepared for anchorage fasteners.

Space fasteners and anchors in accordance with industry standards.

- E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers."
- F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

### 3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
  - 1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- B. Clean adjacent surfaces soiled by hardware installation.
- C Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.
- D. Six-Month Adjustment: Approximately six months after the date of Substantial Completion, the Installer, accompanied by representatives of the manufacturers of latchsets and locksets and of door control devices, and of other major hardware suppliers, shall return to the Project to perform the following work:
  - 1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.
  - 2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
  - 3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.
  - 4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

END OF SECTION

# SECTION 08800 - GLAZING

### 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 glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Window units.
- B. Related Sections: The following sections contain requirements that relate to this Section.

### 1.3 DEFINITIONS

- A. Manufacturer is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.
- B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's directions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- C. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's directions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated glass standard.
- D. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use due to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass. Evidence of failure is the obstruction of vision by dust, moisture, or film on the interior surfaces of glass. Improper practices for maintaining and cleaning glass do not comply with the manufacturer's directions.

## 1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems that are produced, fabricated, and installed to

## GLAZING

withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.

- B. Glass Design: Glass thicknesses indicated on Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:
  - 1. Minimum glass thickness, nominally, of lites in exterior walls is 4.7 mm (.1875 inch).
  - 2. Tinted and heat-absorbing glass thicknesses for each tint indicated are the same throughout Project.
- C. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 1.5 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each glass product and glazing material indicated.
- C. Samples for verification purposes of 12-inch-square samples of each type of glass indicated except for clear monolithic glass products, and 12-inch-long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative in color of the adjoining framing system.
- D. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.
  - 1. Separate certifications are not required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.
- E. Compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.

- F. Compatibility test report from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.
- G. Product test reports for each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.
- H. Maintenance data for glass and other glazing materials to include in Operating and Maintenance Manual specified in Division 1.

## 1.6 QUALITY ASSURANCE

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. FGMA Publications: "FGMA Glazing Manual."
  - 2. SIGMA Publications: TM-3000 "Vertical Glazing Guidelines" and TB-3001 "Sloped Glazing Guidelines."
- B. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.
  - 1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.
- C. Fire-Resistive Glazing Products for Door Assemblies: Products identical to those tested per ASTM E 152, labeled and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:
  - 1. Insulating Glass Certification Council (IGCC).
  - 2. Associated Laboratories, Inc. (ALI).
  - 3. National Certified Testing Laboratories (NCTL).
- E. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.
- F. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:
  - 1. Primary glass of each (ASTM C 1036) type and class indicated.

- 2. Heat-treated glass of each (ASTM C 1048) condition indicated.
- 3. Laminated glass of each (ASTM C 1172) kind indicated.
- 4. Insulating glass of each construction indicated.
- G. Single-Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.
- H. Preconstruction Compatibility and Adhesion Testing: Submit to sealant manufacturers, samples of each glass, gasket, glazing accessory, and glass-framing member that will contact or affect glazing sealants for compatibility and adhesion testing as indicated below:
  - 1. Use test methods standard with sealant manufacturer to determine if priming and other specific preparation techniques are required for rapid, optimum glazing sealants adhesion to glass and glazing channel substrates.
  - 2. Testing is not required when glazing sealant manufacturer can submit required preparation data that is acceptable to Architect and is based on previous testing of current sealant products for adhesion to and compatibility with submitted glazing materials.

# 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
  - 1. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator's recommendations for venting and sealing to avoid hermetic seal ruptures.

## 1.8 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.

# 1.9 WARRANTY

- A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- B. Manufacturer's Warranty on Insulating Glass: Submit written warranty signed by manufacturer of insulating glass agreeing to furnish replacements for insulating glass units that deteriorate as defined in "Definitions" article, f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling,

installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.

1. Warranty Period: Manufacturer's standard but not less than 20 years (prorated) after date of Substantial Completion.

PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the products specified in Product Data Sheets at end of this Section.
- 2.2 PRIMARY FLOAT GLASS PRODUCTS
  - A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Class as indicated below, and Quality q3 (glazing select).
    - 1. Class 1 (clear) unless otherwise indicated.
  - B. Refer to requirements for sealed insulating glass units for performance characteristics of assembled units composed of tinted glass, coated or uncoated, relative to visible light transmittance, U-values, shading coefficient, and visible reflectance.

## 2.3 INSULATING GLASS PRODUCTS

- A. Sealed Insulating Glass Units: Preassembled units consisting of organically sealed lites of glass separated by dehydrated air spaces complying with ASTM E 774 and with other requirements indicated, including those in Insulating Glass Product Data Sheet at the end of this Section.
  - 1. For properties of individual glass lites making up units, refer to requirements specified elsewhere in this Section applicable to types, classes, kinds, and conditions of glass products comprising lites of insulating glass units.
  - 2. Provide heat-treated, coated float glass of kind indicated or, if not otherwise indicated, Kind HS (heat strengthened) where recommended by manufacturer to comply with system performance requirements specified and Kind FT (fully tempered) where safety glass is designated or required.
  - 3. Performance characteristics designated for coated insulating glass are nominal values based on manufacturer's published test data for units with lites 4.7 mm (.1875 inch) thick and nominal 5/8-inch dehydrated space between lites, unless otherwise indicated.
  - 4. U-values are expressed as Btu/hour x sq. ft. x deg F.

## 2.4 ELASTOMERIC GLAZING SEALANTS

## GLAZING

- A. General: Provide products of type indicated, complying with the following requirements:
  - 1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.
  - 3. Colors: Provide color of exposed joint sealants to comply with the following:
    - a. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.
- B. Elastomeric Glazing Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with ASTM C 920 requirements indicated on each Elastomeric Glazing Sealant Product Data Sheet at the end of this Section, including those referencing ASTM classifications for Type, Grade, Class and Uses.
- C. Glazing Sealant for Fire-Resistant Glazing Products: Identical to product used in test assembly to obtain fire-resistive rating.

## 2.5 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, nonstaining and nonmigrating in contact with nonporous surfaces, with or without spacer rod as recommended by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with AAMA 800 for products indicated below:
  - 1. AAMA 806.1.
- B. Expanded Cellular Glazing Tape: Closed-cell, polyvinyl chloride foam tape, factory coated with adhesive on both surfaces, packaged on rolls with release liner protecting adhesive, and complying with AAMA 800 for product 810.5.
- C. Available Products: Subject to compliance with requirements, glazing tape that may be incorporated in the Work include, but is not limited to, the following:
- D. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Back-Bedding Mastic Glazing Tape Without Spacer Rod:
    - a. Dyna-Seal, Pecora Corp.
    - b. PTI 626 Architectural Sealant Tape, Protective Treatments, Inc.
    - c. S-M 5710 H.P Poly-Glaze Tape Sealant, Schnee-Morehead, Inc.

d. SST-800 Tape, Tremco, Inc.

### 2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

### 2.7 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
  - 2. Presence and functioning of weep system.
  - 3. Minimum required face or edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

## 3.3 GLAZING, GENERAL

- A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions as indicated on Drawings provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass from edge damage during handling and installation as follows:
  - 1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
  - 2. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
  - 1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

# 3.4 TAPE GLAZING

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

## 3.5 PROTECTION AND CLEANING

- A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.
- E. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

## INSULATING GLASS PRODUCT DATA SHEET

Classification of Units: Class C, CB or CBA. per ASTM E 774.

<u>Air Space Width</u>: Nominal 5/8 inch measured perpendicularly from surfaces of glass lites at unit's edge.

<u>Sealing System</u>: Dual seal, primary and secondary sealants: manufacturer's standard sealants.

Spacer Specifications: Manufacturer's standard metal.

Dessicant: Either molecular sieve or silica gel or blend of both.

Corner Construction: Manufacturer's standard corner construction.

Color of Spacer: Color as selected by Architect from manufacturer's standard colors.

<u>Glass Specifications</u>: Comply with the following requirements:

Thickness of Each Lite: 3/16" min.

Uncoated Indoor Lite: Class 1 (clear) float glass.

<u>Uncoated</u> <u>Outdoor Lite</u>: Class 1 (clear) float glass

Nominal Performance Characteristics are as indicated below:

Visible Light Transmittance: 75-93 percent

## ELASTOMERIC GLAZING SEALANT PRODUCT DATA SHEET

Base Polymer: Urethane.

<u>Type</u>: M (multicomponent.

Grade: NS (nonsag).

<u>Class</u>: 25.

<u>Use Related to Exposure</u>: NT (nontraffic).

<u>Uses Related to Glazing Substrates</u>: M, G, A, and, as applicable to glazing substrates indicated, O.

GLAZING

<u>Use O Glazing Substrates</u>: Coated glass, color anodized aluminum, aluminum coated with a high-performance coating, galvanized steel, wood, elastomeric glazing gaskets and glazing accessories.

END OF SECTION 08800

## SECTION 09111 - NON-LOAD-BEARING STEEL FRAMING

## 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 non-load-bearing steel framing members for the following applications:
  - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
  - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).
- B. Related Sections include the following:
  - 1. Refer to "Gypsum Board Assemblies 09255"

### 1.3 SUBMITTALS

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

### 1.4 QUALITY ASSURANCE

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

## PART 2 - PRODUCTS

## 2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  - 2. Protective Coating: **ASTM A 653/A 653M, G60 (Z180).**

## 2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inchdiameter wire, or double strand of 0.0475-inch- diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
  - 1. Depth: As indicated on Drawings 1-1/2 inches.
- E. Furring Channels (Furring Members):
  - 1. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
  - 2. Steel Studs: ASTM C 645.
    - a. Minimum Base-Metal Thickness 0.0179 inch (0.45 mm).
    - b. Depth: As indicated on Drawings.
  - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
    - a. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
  - 4. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.
    - a. Configuration: Asymmetrical or hat shaped.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; Drywall Furring System.
    - c. USG Corporation; Drywall Suspension System.

### 2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).
  - 2. Depth: As indicated on Drawings.
- B. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: .060 inch.
- C. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
  - 1. Depth: 1-1/2 inches.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
  - 2. Depth: As indicated on Drawings 7/8 inch (22.2 mm).
- E. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical or hat shaped.
- F. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
  - 1. Depth: 3/4 inch (19.1 mm).
  - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
  - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inchdiameter wire, or double strand of 0.0475-inch- diameter wire.
- G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

### 2.4 AUXILIARY MATERIALS

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

- B. Isolation Strip at Exterior Walls: Provide **one of** the following:
  - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
  - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

### PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollowmetal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
  - 1. 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.
- B. Coordination with Sprayed Fire-Resistive Materials:
  - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (600 mm) o.c.
  - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

### 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
  - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
- 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
- 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
- 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

## 3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within **performance limits established by referenced installation standards.**
  - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

- 5. Do not attach hangers to steel roof deck.
- 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
- 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
- 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

# 3.5 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
  - 1. Space studs as follows:
    - a. Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
    - b. Multilayer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
    - c. Tile backing panels: **16 inches (406 mm)** o.c., unless otherwise indicated.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb, unless otherwise indicated.
    - Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.

- c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
- 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistancerated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
  - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- 6. Curved Partitions:
  - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
  - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.
- D. Direct Furring:
  - 1. Screw to wood framing.
  - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09111

# SECTION 09255 - GYPSUM BOARD ASSEMBLIES

# 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. Non-load-bearing steel framing members for gypsum board assemblies.
  - 2. Gypsum board assemblies attached to steel framing.
  - 3. Gypsum board bonded adhesively to interior concrete and masonry substrates.
  - 4. Cementitious backer units installed with gypsum board assemblies.
  - 5. Glass-mat, water-resistant gypsum backing board installed with gypsum board assemblies.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 7 Section "Firestopping" for firestopping systems and fire-resistive-rated joint sealants.

#### 1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

### 1.4 ASSEMBLY PERFORMANCE REQUIREMENTS

#### 1.5 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
- C. Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

## 1.6 QUALITY ASSURANCE

## GYPSUM BOARD ASSEMBLIES

- A. Fire-Test-Response Characteristics: Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Fire Resistance Ratings: As indicated by reference to GA File Numbers in GA-600 "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer.
- C. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.
- D. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.
- E. Field Samples: On actual gypsum board assemblies, prepare field samples of at least 100 sq. ft. in surface area for the following applications. Simulate finished lighting conditions for review of in-place unit of Work.
  - 1. Wall surfaces indicated to receive nontextured paint finishes.
  - 2. Ceiling surfaces indicated to receive nontextured paint finishes.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.
- C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

## 1.8 PROJECT CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.
- B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when

using temporary heat sources.

C. Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Steel Framing and Furring:
    - a. Alabama Metal Industries Corp.
    - b. Consolidated Systems, Inc.
    - c. Dale Industries, Inc.
    - d. Dietrich Industries, Inc.
    - e. Marino Industries Corp.
    - f. Gold Bond Building Products Div., National Gypsum Co.
    - g. Unimast Inc.
  - 2. Gypsum Board and Related Products:
    - a. Domtar Gypsum.
    - b. Georgia-Pacific Corp.
    - c. Gold Bond Building Products Div., National Gypsum Co.
    - d. United States Gypsum Co.

2.2 STEEL FRAMING FOR WALLS AND PARTITIONS

- A. General: Provide steel framing members complying with the following requirements:
  - 1. Component Sizes and Spacings: As indicated but not less than that required to comply with ASTM C 754 under the following maximum deflection and lateral loading conditions:
    - a. Maximum Deflection: L/240 at 5 lbf per sq. ft.
  - 2. Protective Coating: G40 hot-dip galvanized coating per ASTM A 525 for framing members attached to and within 10 feet of exterior walls.
- B. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:
  - 1. Depth: 7/8 inch.
  - 2. Thickness: 20 ga., unless otherwise indicated.

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C. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

## 2.3 GYPSUM BOARD PRODUCTS

- A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.
  - 1. Thickness: Provide gypsum board in thicknesses indicated or, if not otherwise indicated, in 5/8 inch thicknesses to comply with ASTM C 840 for application system and support spacing indicated.
- B. Gypsum Wallboard: ASTM C 36 and as follows:
  - 1. Type: Type X where required for fire-resistive-rated assemblies.
  - 2. Edges: Tapered.
  - 3. Thickness: 5/8 inch, unless otherwise indicated. <sup>3</sup>/<sub>4</sub> inch for exterior rated wall.
  - 4. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work where proprietary gypsum wallboard is indicated include, but are not limited to, the following:
    - a. Fire-Shield Gypsum, National Gypsum Products
    - b. Toughrock Fireguard, Georgia-Pacific Corp.
    - c. Fire-Shield FSW, Gold Bond Building Products Div., National Gypsum Co.
- C. Water-Resistant Gypsum Backing Board: ASTM C 630 and as follows:
  - 1. Type: Type X where required for fire-resistive-rated assemblies.
  - 2. Thickness: 5/8 inch, unless otherwise indicated.
- D. Exterior Gypsum Soffit Board: ASTM C 1396, with manufacturer's standard edges, of type and thickness indicated below:
  - 1. Type: Type X where required for fire-resistive-rated assemblies.
  - 2. Thickness: 5/8 inch, unless otherwise indicated.
  - 3. Product: Subject to compliance with requirements, provide Toughrock soffit board units manufactured by Georgia Pacific Corp.
- E. Glass-Mat Gypsum Sheating Board: ASTM C 1177/C 1177/M
  - 1. Product: Subject to compliance with requirements, provide Dens-Glass

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Gold by G-P

Gypsum.

2. Core: ½ inch tongue and groove.

#### 2.4 TRIM ACCESSORIES

- A. Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:
  - 1. Material: Formed metal, plastic, or metal combined with paper, with metal complying with the following requirement:
    - a. Sheet steel zinc-coated by hot-dip process.
    - b. Sheet steel coated with zinc by hot-dip or electrolytic processes, or with aluminum or rolled zinc.
  - 2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:
    - a. Cornerbead on outside corners, unless otherwise indicated.
    - b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim unless otherwise indicated.
    - c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
    - d. One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.

#### 2.5 JOINT TREATMENT MATERIALS

- A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
- B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.
- C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
  - 1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
  - 2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.
  - 3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.

- 4. For topping compound, use sandable formulation.
- D. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
  - 1. Ready-Mixed Formulation: Factory-mixed product.
  - 2. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
  - 3. Topping compound formulated for fill (second) and finish (third) coats.
  - 4. All-purpose compound formulated for both taping and topping compounds.

#### 2.6 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.
- B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.
- C. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot grouting hollow metal door frames.
- D. Fastening Adhesive for Wood: ASTM C 557.
- E. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum panels to steel framing.
- F. Steel drill screws complying with ASTM C 1002 for the following applications:
  - 1. Fastening gypsum board to wood members.
  - 2. Fastening gypsum board to gypsum board.
- G. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.
- H. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation

until unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

#### 3.3 INSTALLING FRAMING, GENERAL

- A. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.
- B. Isolate framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
  - 1. Where building structure abuts ceiling perimeter or penetrates ceiling.
  - 2. Where partition framing and wall furring abut structure except at floor.
- C. Do not bridge building expansion and control joints with framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

#### 3.4 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.
- B. Install ceiling board panels across framing to minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install wall/partition board panels to minimize the number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one framing member in alternate courses of board. At stairwells and other high walls, install panels horizontally with end abutting joints over studs and staggered.
- Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- E. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges abut field-cut edges and ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions. Avoid joints at corners of framed openings where possible.

- F. Attach gypsum panels to studs so that the leading edge or end of each panel is attached to open (unsupported) edges of stud first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors, and doors over 32 inches wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.
- I. Form control joints and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
- J. Cover both faces of stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chase walls that are braced internally.
  - 1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4-to-1/2-inch-wide joints to install sealant.
- K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4-inch-to-1/2-inch-wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- L. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

#### 3.5 GYPSUM BOARD APPLICATION METHODS

- A. Single-Layer Application: Install gypsum wallboard panels as follows:
  - 1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless parallel application is required for fire-resistive-rated assemblies. Use maximum-length panels to minimize end joints.
  - 3. On furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

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- B. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:
  - 1. Fasten with screws.
- C. Direct-Bonding to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members or base layer of gypsum board), comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- D. Exterior Soffits and Ceilings: Apply exterior gypsum soffit board panels perpendicular to supports, with end joints staggered over supports. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
  - 1. Fasten with corrosion-resistant screws.

### 3.6 INSTALLING TRIM ACCESSORIES

- A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.
- B. Install corner beads at external corners.
- C. Install edge trim where edge of gypsum panels would otherwise be exposed or semiexposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.
  - 1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
  - 2. Install L-bead where edge trims can only be installed after gypsum panels are installed.

## 3. "J" TRIM applications are not permitted.

- D. Install control joints at locations indicated, and where not indicated according to ASTM C 840, and in locations approved by Architect for visual effect.
- E. Install H-molding in exterior gypsum board assemblies where control joints are indicated. Install on cut or ends of gypsum panels, not on tapered edges.

#### 3.7 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.
- B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

- C. Apply joint tape over gypsum board joints except those with trim accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.
- D. Apply joint tape over gypsum board joints and to trim accessories with concealed face flanges as recommended by trim accessory manufacturer and as required to prevent cracks from developing in joint compound at flange edges.
- E. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.
  - 1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
  - 2. Level 4 for gypsum board surfaces indicated to receive light-textured finishes, wallcoverings, and flat paints over light textures.
- F. For level 4 gypsum board finish, embed tape in finishing compound plus two separate coats applied over joints, angles, fastener heads, and trim accessories using the following combination of joint compounds (not including prefill), and sand between coats and after last coat:
  - 1. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound.
  - 2. Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
  - 3. Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
- G. Finish exterior gypsum soffit board using setting-type joint compounds to prefill joints and embed tape, and for first, fill (second) and finish (third) coats, with the last coat being a sandable product. Smooth each coat before joint compound hardens to minimize need for sanding. Sand between coats and after finish coat.
  - 1. Painting exterior gypsum soffit board after finish coat has dried is specified in Division 9 Section "Painting."

## 3.8 CLEANING AND PROTECTION

- A. Promptly remove any residual joint compound from adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner suitable to Installer, that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION 09255

# SECTION 09310 - CERAMIC TILE

## PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
  - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.
- 1.2 SUMMARY
  - A. This Section includes the following:
    - 1. Porcelain tile and trim.
  - B. Related Sections include the following:
    - 1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
- 1.3 DEFINITIONS
  - A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
  - B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C 499).
  - C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
  - 1. Level Surfaces: Minimum 0.6.
- B. Load-Bearing Performance: For ceramic tile installed on walkway surfaces, provide installations rated for the following load-bearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated for this Project:

#### 1.5 SUBMITTALS

- A. Product Data: For each type of tile, mortar, grout, and other products specified.
- B. Shop Drawings: For the following:
  - 1. Tile patterns and locations.

CERAMIC TILE

# 2. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

- C. Tile Samples for Initial Selection: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.
- D. Grout Samples for Initial Selection: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.
- E. Samples for Verification: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.
  - 1. Each type and composition of tile and for each color and texture required, at least 12 inches (300 mm) square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Architect.
  - 2. Full-size units of each type of trim and accessory for each color required.
- F. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- G. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.
- H. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of architects and owners, and other information specified.
- I. Tile Test Reports: Indicate and interpret test results for compliance of special-purpose tile with specified requirements.
- J. Setting Material Test Reports: Indicate and interpret test results for compliance of tile-setting and -grouting products with specified requirements.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

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- C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:
  - 1. Joint sealants.
- E. Mockups: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.
  - 1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
  - 2. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
  - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 4. Obtain Architect's approval of mockups before proceeding with final unit of Work.
  - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
    - 1. When directed, demolish and remove mockups from Project site.
    - 2. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."
- 1.7 DELIVERY, STORAGE, AND HANDLING
  - A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
  - B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
  - C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.
- 1.8 PROJECT CONDITIONS

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A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

# 1.9 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Tile Products:
    - a. Porcelain Tile
      - 1. Dal-Tile
  - 2. Tile-Setting and -Grouting Materials:
    - a. American Olean Tile Company.
    - b. Atlas Minerals & Chemicals, Inc.
    - c. Bonsal: W.R. Bonsal Company.
    - d. Bostik.
    - e. Dal-Tile Corporation.
    - f. DAP, Inc.
    - g. Summitville Tiles, Inc.
    - h. TEC Incorporated.

## 2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.

- 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI

standards referenced in "Setting Materials" and "Grouting Materials" articles.

- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
  - 1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.
  - 2. Provide tile trim and accessories that match color and finish of adjoining flat tile.
- D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.
- 2.3 TILE PRODUCTS
  - A. Unpolished Porcelain Tile: Provide square-edged flat tile complying with the requirements.
  - B. Quarry Tile: Standard Grade Conforming to ANSI A137.1
    - 1. Unglazed square edge flat tile.
    - 2. Non abrasive.
    - 3. Size: 12"x 12" x 1/2".
    - 4. Face: See Room Finish Schedule.

## 2.5 GROUTING MATERIALS

- A. Commercial Portland Cement Grout (Sanded Grout): ANSI A118.6, color as indicated, for joints 1/8 inch (3.2 mm) or wider.
- B. Latex-Portland Cement Grout: ANSI A118.6 for materials described in Section H-2.4, composed as follows:
  - 1. Factory-Prepared, Dry-Grout Mixture: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to produce the following:
    - a. Unsanded grout mixture for joints 1/8 inch (3.2 mm) and narrower.
  - 2. Mixture of Dry-Grout Mix and Latex Additive: Mixture of factory-prepared, dry-grout mix and latex additive complying with the following requirements:
    - a. Unsanded Dry-Grout Mix: Dry-set grout complying with ANSI A118.6 for materials described in Section H-2.3, for joints 1/8 inch (3.2 mm) and narrower.
    - b. Sanded Dry-Grout Mix: Commercial portland cement grout complying with

ANSI A118.6 for materials described in Section H-2.1, for joints 1/8 inch (3.2 mm) and wider.

- c. Latex Additive: Acrylic resin.
- 2.6 ELASTOMERIC SEALANTS
  - A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section "Joint Sealants."
  - B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
  - C. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
  - D. Available Products: Subject to compliance with requirements, products which may be incorporated into the Work include, but are not limited to, the following:
  - E. Products: Subject to compliance with requirements, provide one of the following:
    - 1. Multipart, Pourable Urethane Sealants:
      - a. Chem-Calk 550; Bostik.
      - b. NR-200 Urexpan; Pecora Corp.
      - c. THC-900; Tremco, Inc.

## 2.7 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.
- B. Metal Edge Strips: White-zinc-alloy terrazzo strips, 1/8 inch (3.2 mm) wide at top edge with integral provision for anchorage to mortar bed or substrate, unless otherwise indicated.
- C. Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.
  - 1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a temporary protective coating for tile.
- 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.

#### 2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## 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 installed tile.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
  - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
  - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.
- B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.
  - 1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
  - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in 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.

- D. Field-Applied Temporary Protective Coating: Where needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:
  - 1. Grout release.

#### 3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
  - 1. TCA Specification F113
  - 2. TCA Specification F112
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. 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.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
- F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
  - 2. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."
- G. Grout tile to comply with the requirements of the following tile installation standards:
  - 1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.
- 3.5 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.
- B. Joint Widths: Install tile on floors with the following joint widths:
- C. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
  - 1. Tile floors composed of rib-backed tiles.

#### 3.6 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove latex-portland cement grout residue from tile as soon as possible.
  - 2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
  - 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.
  - 1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
  - 2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09310

CERAMIC TILE

# SECTION 09511 - ACOUSTICAL PANEL CEILINGS

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes ceilings composed of acoustical panels and exposed suspension systems.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 16 Section "Interior Lighting Fixtures" for lighting fixtures in acoustical ceilings.

#### 1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
- C. Coordination drawings for reflected ceiling plans drawn accurately to scale and coordinating penetrations and ceiling-mounted items. Show the following:
  - 1. Ceiling suspension system members.
  - 2. Method of attaching suspension system hangers to building structure.
  - 3. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
  - 4. Minimum Drawing Scale: 1/4 inch = 1 foot.
- D. Samples for verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
  - 1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.

- 2. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.
- E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- F. Product test reports from a qualified independent testing agency that are based on its testing of current products for compliance of acoustical panel ceilings and components with requirements.
- G. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that show compliance of acoustical panel ceilings and components with the building code in effect for the Project.

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
  - 1. Fire-response tests are performed by a qualified testing and inspecting agency. Qualified testing and inspecting agencies include Underwriters Laboratories (UL), or another agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
  - 2. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.
- C. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- D. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will

be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

### 1.6 PROJECT CONDITIONS

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

#### 1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition assemblies (if any).

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
  - 1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 2.0 percent of amount installed.
  - 2. Exposed Suspension System Components: Furnish quantity of each exposed component equal to 2.0 percent of amount installed.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, acoustical panels that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Mineral Fiber, Medium Texture
    - a. Cortega 770, Armstrong World Industries, Inc.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the products specified in each Acoustical Panel Ceiling Product Data Sheet at the end of this Section.

## 2.2 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
  - 1. Mounting Method for Measuring Noise Reduction Coefficient (NRC): Type E-400 (plenum mounting in which face of test specimen is 15-3/4 inches [400 mm] away from the test surface) per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
  - 1. Where appearance characteristics of acoustical panels are indicated by reference to ASTM E 1264 pattern designations and not to manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range of products that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Panel Characteristics: Comply with requirements indicated on each Acoustical Panel Ceiling Product Data Sheet at the end of this Section, including those referencing ASTM E 1264 classifications.

#### 2.3 CEILINGS OF WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS

- A. Panel Characteristics: Type III, Form 2 acoustical panels per ASTM E 1264, with painted finish, complying with pattern and other requirements indicated below:
  - 1. Pattern: Panels fitting ASTM E 1264 pattern designations (CD) indicated below: a. Cortega 770
  - 2. Color/Light Reflectance Coefficient: White/LR 0.82.
  - 3. Noise Reduction Coefficient: NRC 0.55.
  - 4. Ceiling Sound Transmission Class: CAC 33
  - 5. Edge Detail: Square.
  - 6. Thickness: 5/8 inch.
  - 7. Size: 24 by 24 inches.

#### 2.4 METAL PANEL CEILINGS;

 A. Panel to be of aluminum lay-in 24"x24" by DEORATIVE CEILINGS "Edgerton Square" # 2401 white. Provide suitable grid by this manufacturer or others similar to grid system in Par. 2.5 of this specification

## 2.5 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.
  - 1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- C. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated Carbon Steel Wire: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so that its stress at 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than the yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
- E. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.
- F. Flat Hangers: Mild steel, zinc coated, or protected with rust-inhibitive paint.
- G. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide, formed with 0.0396-inch- (1-mm-) thick galvanized-steel sheet complying with ASTM A 446, G 90 (ASTM A 446M, Z 275) Coating Designation, with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
- H. Sheet-Metal Edge Moldings and Trim: Type and profile indicated, or if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
  - 1. For lay-in panels with reveal edge details, provide stepped-edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
  - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

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

## 2.4 DIRECT-HUNG SUSPENSION SYSTEMS

A. For Cortega Tile

1. Available Products: Subject to compliance with requirements, suspension systems that may be incorporated in the Work include, but are not limited to, the following:

- a. Wide-Face, Double-Web, Steel Suspension Systems:
- (1) Prelude ML Grid, 15/16" Exposed Tee System; Armstrong World Industries,

Inc.

### 2.5 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:
  - 1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.
- C. Available Products: Subject to compliance with requirements, acoustical sealants that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Acoustical Sealant for Exposed and Concealed Joints:
    - a. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
    - b. SHEETROCK Acoustical Sealant; United States Gypsum Company.
  - 2. Acoustical Sealant for Concealed Joints:
    - a. BA-98; Pecora Corp.
    - b. Tremco Acoustical Sealant; Tremco, Inc.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine substrates and structural framing to which acoustical panel ceilings attach or

abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
- B. Measure each ceiling area and establish the layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans.

## 3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's instructions and CISCA "Ceiling Systems Handbook."
  - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of the supporting structure or of the ceiling suspension system.
  - 2. Splay hangers only where required, and if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of 3 tight turns. Connect hangers either directly to structures or to inserts, eye screws, or other devices that are secure, that are appropriate for substrate, and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

6. Do not attach hangers to steel deck tabs.

# 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.

- 8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise shown; and provide hangers not more than 8 inches (200 mm) from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Screw attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
  - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide neat, precise fit.
  - 1. Arrange directionally patterned acoustical panels as follows:
    - a. Install panels in a basket-weave pattern.
  - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  - 3.. Paint the cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended for this purpose by acoustical panel manufacturer.
  - 5. Install hold-down clips in areas indicated and in areas required by governing regulations, or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.
  - 6. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

## 3.4 CLEANING

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

END OF SECTION 09511

# NORTH STAR FAMILY DENTISTRY

# SECTION 09652 - SHEET VINYL FLOOR COVERINGS

# 1PART - GENERAL

## 1.1 SUMMARY

A. This Section includes sheet vinyl floor coverings, without backings.

## 1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (150by-230-mm) sections of each different color and pattern of floor covering required.

## 1.3 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than [85 deg F (29 deg C), in spaces to receive floor tile during the following time periods:
- 1. 48 hours before installation.
- 2. During installation.
- 3. 48 hours after installation.
- B. After post installation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install floor coverings after other finishing operations, including painting, have been completed.

# 1.4 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. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each color, pattern, and type of floor covering installed.

## 2PART - PRODUCTS

2.1 SHEET VINYL FLOOR COVERING

#### SHEET VINYL FLOOR COVERINGS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of following:

- 1. Metroflor---KONECTO Provide Manufacturer's 6 year warranty.
- C. Solid Vinyl Tile, Class III, Type B
- D. Color and Pattern: As selected from manufacturers full range of Sierra Plank.
- E. Wearing Surface: Smooth.
- F. Sheet Width: As standard with manufacturer 6" x 36"
- G. Seaming Method: Standard.

H. Fire-Test-Response Characteristics: 1.Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

- 2.2 INSTALLATION MATERIALS
- A. Edge Strips: Vinyl of height required to protect exposed edges of floor coverings, and in maximum available lengths to minimize running joints.
- **3PART EXECUTION**
- 3.1 PREPARATION
- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.
- B. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- 1. Do not install floor coverings until they are same temperature as space where they are to be installed.
- D. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION

# SHEET VINYL FLOOR COVERINGS

A. Lay out sheet vinyl floor coverings as follows:

1.Follow manufacturers system for pattern. Floor covering is loose laid with no adhesives.

- B. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.
- C. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
- D. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.
- E. Perform the following operations immediately after completing floor covering installation:
- 1. Remove adhesive and other blemishes from floor covering surfaces.
- 2. Sweep and vacuum floor coverings thoroughly.
- 3. Damp-mop floor coverings to remove marks and soil.
- a. Do not wash floor coverings until after time period recommended by manufacturer.
- F. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 09652

# SECTION 09680 - CARPET

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes carpet, installation, accessories, and cushion.
- B. Related Sections: The following sections contain requirements that relate to this Section:

#### 1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Specification Sections.
- B. Product data for each type of carpet material and installation accessory required. Submit written data on physical characteristics, durability, resistance to fading, and flame resistance characteristics.
- C. Shop drawings showing layout and seaming diagrams. Indicate pile or pattern direction and locations and types of edge strips. Indicate columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet. Show installation details at special conditions.
- D. Samples for verification purposes in manufacturer's standard size, showing full range of color, texture, and pattern variations expected. Prepare samples from same material to be used for the Work. Submit the following:
  - 1. 12-inch-square samples of each type of carpet material required.
  - 2. 12-inch-long samples of each type exposed edge stripping and accessory item.
  - 3. 6-inch-square samples of each type of carpet cushion.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualification: Firm whose carpet materials comply with "Use of Materials Bulletin UM-44C" published by U.S. Department of Housing and Urban Development (HUD) and are currently listed in HUD "Certified Products Directory" and so identified by imprint on back of carpet.
- B. Carpet Surface Burning Characteristics: Provide carpet identical to that tested for the following fire performance characteristics, per test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify carpet with appropriate markings of applicable testing and inspecting organization.

- 1. Test Method: DOC FF 1-70.
- 2. Rating: Pass.
- C. Cushion Surface Burning Characteristics: Provide carpet cushion identical to that tested for the following fire performance characteristics, per test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify carpet cushion with appropriate markings of applicable testing and inspecting organization.
  - 1. Test Method: DOC FF 1-70.
  - 2. Rating: Pass.
  - 3. Test Method: ASTM E 84.
  - 4. Flame Spread: 25 or less.
  - 5. Smoke Developed: 450 or less.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.
- B. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity. Lay flat, blocked off ground. Maintain minimum temperature of 68 deg F (20 deg C) at least three days prior to and during installation in area where materials are stored.

#### 1.6 PROJECT CONDITIONS

- A. Substrate Conditions: No condensation within 48 hours on underside of 4-foot by 4-foot polyethylene sheet, fully taped at perimeter to substrate.
- B. Substrate Conditions: pH of 9 or less when substrate wetted with potable water and pHydrion paper applied.

#### 1.7 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels describing contents.
  - 1. Carpet: Before installation begins, furnish quantity of full width for each type of material equal to 5 percent of amount installed.

#### 1.8 WARRANTY

- A. 15 years against excessive surface wear, edge ravel and delamination of secondary backing from face fiber.
- PART 2 PRODUCTS:
  - A. See Finish Schedule for Type.

## CARPET
# 2.1 ACCESSORIES

- A. Carpet Edge Guard: See resilient wall base and accessories Section 09678.
- B. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- C. Carpet Adhesive: Water resistant and nonstaining as recommended by carpet manufacturer to comply with flammability requirements for installed carpet.
- D. Carpet Wall Base

# PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clear away debris and scrape up cementitious deposits from concrete surfaces to receive carpet; apply sealer to prevent dusting.
- B. Patch holes and level to a smooth surface. If previous finish chemically stripped, reseal concrete. Seal powdery or porous surfaces with sealer recommended by carpet manufacturer.
- C. Patch holes and cracks. Sand to level. Remove wax. Seal surface with sealer recommended by carpet manufacturer.
- D. Replace missing pieces of existing resilient flooring or patch to level. Cut out peaked sheet goods seams and fill with latex underlayment.
- E. Remove chemical finish on terrazzo; patch grout lines and cracks to level with latex underlayment.

# 3.2 INSTALLATION

- A. Comply with manufacturer's recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under door in closed position; do not place seams perpendicular to door frame, in direction of traffic through doorway. Do not bridge building expansion joints with continuous carpet.
- B. Extend carpet under removable flanges and furnishings and into alcoves and closets of each space.
- C. Provide cutouts where required, and bind cut edges where not concealed by protective

CARPET

edge guards or overlapping flanges.

- D. Install carpet edge guard where edge of carpet is exposed; anchor guards to substrate.
- E. Install with pattern parallel to walls and borders.
- F. Install carpet by trimming edges, butting cuts with seaming cement, and taping and/or sewing seams to provide sufficient strength for stretching and continued stresses during life of carpet.
- G. Fit sections of carpet prior to application of adhesive. Trim edges and butt cuts with seaming cement.
- H. Apply adhesive uniformly to substrate in accordance with manufacturer's instructions. Butt edges tight to form seams without gaps. Roll entire area lightly to eliminate air pockets and ensure uniform bond.

### 3.3 CLEANING

- A. Remove adhesive from carpet surface with manufacturer's recommended cleaning agent.
- B. Remove and dispose of debris and unusable scraps. Vacuum with commercial machine with face-beater element. Remove soil. Replace carpet where soil cannot be removed. Remove protruding face yarn.
- C. Vacuum carpet.

# 3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, to ensure carpet is not damaged or deteriorated at time of Substantial Completion.

END OF SECTION 09680

# SECTION 09900 - PAINTING

# 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 surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
  - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other Sections.
- B. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
  - 1. Painting includes field-painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
  - 1. Prefinished items not to be painted include the following factory-finished components:
    - a. Acoustic materials.
    - b. Finished mechanical and electrical equipment.
    - c. Light fixtures.
    - d. Switchgear.
    - e. Distribution cabinets.
  - 2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
    - a. Foundation spaces.
    - b. Furred areas.
    - c. Utility tunnels.
    - d. Pipe spaces.
    - e. Duct shafts.

- 3. Finished metal surfaces not to be painted include:
  - a. Anodized aluminum.
  - b. Stainless steel.
  - c. Chromium plate.
  - d. Copper.
  - e. Bronze.
  - f. Brass.
- 4. Operating parts not to be painted include moving parts of operating equipment, such as the following:
  - a. Valve and damper operators.
  - b. Linkages.
  - c. Sensing devices.
  - d. Motor and fan shafts.
- 5. Labels: Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 5 Section "Structural Steel" for shop-priming structural steel.
  - 2. Division 5 Section "Metal Fabrications" for shop-priming ferrous metal.
  - 3. Division 6 Section "Interior Architectural Woodwork" for shop-priming interior architectural woodwork.
  - 4. Division 6 Section "Exterior Architectural Woodwork" for shop-priming exterior architectural woodwork.
  - 5. Division 6 Section "Custom Casework" for shop-priming custom wood casework.
  - 6. Division 8 Section "Standard Steel Doors and Frames" for shop-priming steel doors and frames.
  - 7. Divisions 15 and 16: Painting mechanical and electrical work is specified in Divisions 15 and 16, respectively.

### 1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each paint system specified, including block fillers and primers.
  - 1. Provide the manufacturer's technical information including label analysis and instructions for handling, storage, and application of each material proposed for use.
  - 2. List each material and cross-reference the specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.
  - 3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

- C. Samples for initial color selection in the form of manufacturer's color charts.
  - 1. After color selection, the Architect will furnish color chips for surfaces to be coated.
- D. Samples for Verification Purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.
  - 1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
  - 2. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.

# 1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to those indicated for the Project that have resulted in a construction record of successful in-service performance.
- B. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- C. Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface until required sheen, color, and texture are obtained; simulate finished lighting conditions for review of in-place work.
  - 1. Final acceptance of colors will be from job-applied samples.
  - 2. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. Apply coatings in this room or surface according to the schedule or as specified.
    - a. After finishes are accepted, this room or surface will be used to evaluate coating systems of a similar nature.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
  - 1. Product name or title of material.
  - 2. Product description (generic classification or binder type).
  - 3. Manufacturer's stock number and date of manufacture.
  - 4. Contents by volume, for pigment and vehicle constituents.
  - 5. Thinning instructions.
  - 6. Application instructions.
  - 7. Color name and number.

- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

# 1.6 JOB CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 90 deg F (32 deg C).
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
  - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

# PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
  - 1. Devoe and Raynolds Co. (Devoe).
  - 2. Fuller O'Brien (Fuller).
  - 3. The Glidden Company (Glidden).
  - 4. Benjamin Moore and Co. (Moore).
  - 5. PPG Industries, Pittsburgh Paints (PPG).
  - 6. Pratt and Lambert (P & L).
  - 7. The Sherwin-Williams Company (S-W).

# 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
- B. Material Quality: Provide the manufacturer's best-quality trade sale paint material of

the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

- 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish the manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Provide color selections made by the Architect from the manufacturer's full range of standard colors.

# 2.3 MASONRY BLOCK FILLER

- A. Filler Coat Materials: Provide the manufacturer's recommended factory-formulated, latex-type concrete masonry block fillers that are compatible with the finish materials indicated.
- B. Products: Subject to compliance with requirements, provide one of the following:
  - 1. High-Performance Latex Block Filler:

a.	PPG:	Pitt-Glaze water based acrylic masonry block filler.
b.	SW:	Preprite Block Filler

# 2.4 PRIMERS

- A. Primers: Provide the manufacturer's recommended factory-formulated primers that are compatible with the substrate and finish coats indicated.
- B. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Concrete and Masonry Primers: Interior, flat, latex-based paint.

a.	Devoe:	51701 Wonder-Prime Interior All Purpose Latex
		Primer Sealer & Vapor Barrier.
b.	Fuller:	202-XX Interior - Exterior Acrylic Latex Wall Paint.
c.	Glidden:	5300 Ultra-Hide Flat Wall Paint.
d.	Moore:	Moore's Latex Quick-Dry Prime Seal #201.
e.	PPG:	80 Line Wallhide Flat Latex Paint.
f.	P & L:	Vapex Latex Flat Wall Finish.
g.	SW:	ProMar 200 Latex Flat B30W200.

2. Gypsum Drywall Primer: White, interior, latex-based primer.

a.	Devoe:	50801 Wonder-Tones Latex Primer and Sealer.
b.	Fuller:	Pro-Tech Interior Latex Wall Primer and Sealer.
c.	Glidden:	5019 PVA Primer.
d.	Moore:	Moore's Latex Quick-Dry Prime Seal #201.

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e.	PPG:	6-2 Quick-Dry Latex Primer Sealer.
f.	P & L:	Latex Wall Primer Z30001.

- SW: ProMar 200 Latex Wall Primer B28W200. g.
- 3. Ferrous Metal Primers: Alkyd-type primers.

a.	Devoe:	41820 Bar-Ox Alkyd Shop/Field Primer Grey.
b.	Fuller:	621-05 Blox-Rust Latex Metal Primer.
c.	Glidden:	5205 Glid-Guard Tank and Structural Primer.
d.	Moore:	IronClad Retardo Rust-Inhibitive Paint #163.
e.	PPG:	6-612 Speedhide Inhibitive White Primer.
f.	P & L:	Effecto Primer Red or White.
g.	SW:	Kem Kromik Metal Primer B50N2/B50W1.

- Kem Kromik Metal Primer B50N2/B50W1. SW:
- Galvanized Metal Primers: 4.

a.	Devoe:	13201 Mirrolac Galvanized Metal Primer.
b.	Fuller:	621-05 Blox-Rust Latex Metal Primer.
C.	Glidden:	5229 Glid-Guard All-Purpose Metal Primer.
d.	Moore:	IronClad Galvanized Metal Latex Primer #155.
e.	PPG:	6-215/216 Speedhide Galvanized Steel Primer.
f.	P & L:	P & L Interior Trim Primer.
g.	SW:	Galvite B50W3.
-		

5. Aluminum Primers:

a.	Devoe:	41820 Bar-Ox Alkyd Shop/Field Primer Grey.
b.	Fuller:	621-05 Blox-Rust Latex Metal Primer.
C.	Glidden:	5229 Glid-Guard All-Purpose Metal Primer.
d.	Moore:	No Primer Required.
e.	PPG:	6-712 Speedhide Inhibitive Metal Primer, White.
f.	P & L:	Effecto Primer Red or White.
g.	SW:	No Primer Necessary.

- 6. Wood Primer:
  - SW Preprite Classic Primer B28W101 a.

# 2.5 UNDERCOAT MATERIALS

- Undercoat Materials: Provide the manufacturer's recommended factory-formulated Α. undercoat materials that are compatible with the substrate and finish coats indicated.
- Products: Subject to compliance with requirements, provide one of the following: Β.
  - 1. Interior Enamel Undercoat: Ready-mixed enamel.

a.	Devoe:	8801 Velour Alkyd Enamel Undercoat.
b.	Fuller:	220-07 Interior Alkyd Enamel Undercoat.
с.	Glidden:	4200 Spred Ultra Semi-Gloss Enamel.

f.

- d. Moore: Moore's Alkvd Enamel Underbody #217. e.
  - PPG: 6-6 Speedhide Quick-Dry Enamel Undercoater.
  - P & L:
- SW: g.

Interior Trim Primer.

ProMar 200 Alkyd Semi-Gloss Enamel B34W200.

# 2.6 INTERIOR FINISH PAINT MATERIAL

- Α. Finish Paint: Provide the manufacturer's recommended factory-formulated finish-coat materials that are compatible with the substrate and undercoats indicated.
- Β. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Interior, Water Base, Latex Paint,
    - SW Promar 200 Latex eggshell a.
  - 2. Interior, Water Base, Epoxy Paint
    - SW Water Based Catalyzed Epoxy a.

B70/B60/V25

- 3. Exterior, Solvent Base Alkyd
  - Industrial Enamel HS, B54Z SE a.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- Examine substrates and conditions under which painting will be performed for Α. compliance with paint application requirements. Surfaces receiving paint must be thoroughly dry before paint is applied.
  - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected.
  - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- Β. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 3. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

# 3.2 PREPARATION

Α. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items, if necessary, to completely paint the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease prior to cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to the manufacturer's instructions for each particular substrate condition and as specified.
  - 1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing about anticipated problems using the specified finish-coat material with substrates primed by others.
  - 2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
    - a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
    - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
  - 3. Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council (SSPC).
    - a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    - b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
  - 4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Materials Preparation: Carefully mix and prepare paint materials according to manufacturer's directions.
  - 1. Maintain containers used in mixing and applying paint in a clean condition, free of

foreign materials and residue.

- 2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
- 3. Use only thinners approved by the paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

# 3.3 APPLICATION

- A. General: Apply paint according to manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  - 1. Paint colors, surface treatments, and finishes are indicated in the schedules.
  - 2. Provide finish coats that are compatible with primers used.
  - 3. The number of coats and the film thickness required are the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce a smooth even surface according to the manufacturer's directions.
  - 4. Apply additional coats if undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
  - 5. The term exposed surfaces includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
  - 6. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.

# NORTH STAR FAMILY DENTISTRY

- 8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
- C. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.
- D. Mechanical items to be painted include, but are not limited to, the following:
  - 1. Piping, pipe hangers, and supports.
  - 2. Heat exchangers.
  - 3. Tanks.
  - 4. Ductwork.
  - 5. Insulation.
  - 6. Supports.
  - 7. Motors and mechanical equipment.
  - 8. Accessory items.
- E. Electrical items to be painted include, but are not limited to, the following:
  - 1. Conduit and fittings.
  - 2. Switchgear.
- F. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- G. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime-coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
  - 1. Provide satin finish for final coats.
- H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with specified requirements.

### 3.4 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
  - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### 3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
  - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

# 3.6 INTERIOR PAINT SCHEDULE

- A. General: Provide an equal to the following paint systems for the various substrates, as indicated.
- B. Gypsum Drywall Systems:
  - 1. Eg-Shel: (3 coats).
    - a. Primer: White, interior, alkali-resistant primer.
      - 1) SW: 1 coat Preprite 200 primer, MDF 1.6 mils per coat.
    - b. Finish Coat: Interior, acrylic epoxy semi-gloss (water base).
      - 1) SW: 2 coats Promar 200 int. latex eg-shel, MDF 1.6 mils per coat.
    - 2. Epoxy: (3 coats)

a. Primer: SW Preprite 200 Latex Paint B28W200 (4 mils wet, 1.2 mils dry)

b. 2<sup>nd</sup>. Coat: SW Water Based Catalyzed Epoxy B70/B60 V25 (2.5 - 3 mils Dry Coat

c. 3<sup>rd</sup>. Coat: SW Water Based Catalyzed Epoxy B70/B60 V25 (2.5 - 3 mils Dry Coat)

- C. Ferrous Metal:
  - 1. Full-Gloss Enamel Finish: Two coats over primer with total dry film thickness not less than 2.5 mils.
    - a. Primer: Synthetic, quick-drying, rust-inhibiting primer.
      - 1) PPG: 6-208 Red Inhibitive Metal Primer.
    - b. Undercoat: Interior enamel undercoat.
      - 2) PPG: 6-6 Speedhide Quick-Dry Enamel Undercoater.
    - c. Finish Coat: Exterior, gloss, alkyd enamel.

1) PPG: 54 Line Quick-Dry Enamel.

# 3.7 EXTERIOR PAINT SCHEDULE

- A. Gypsum Drywall, Wood Trim, Fiberglass Col.
  - 1. Alkyd System
    - a. SW Preprite Masonry Primer B28W300 (7 mil wet/3 mil dry)
    - b. 2<sup>nd</sup>. Coat: SW Water Based Industrial Enamel B53-300 (4 mil wet, 1.6 mil dry)
    - c. 3<sup>rd</sup>. Coat: SW Water Based Industrial Enamel B53-300 (4 mil wet, 1.6 mi dry)

END OF SECTION 09900

# SECTION 10522 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

# 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. Fire extinguisher cabinets.
  - 2. Fire extinguishers
- B. Related Sections: The following Sections contain requirements that relate to this Section:

# 1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for fire extinguisher cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.
- C. Samples for initial selection purposes in the form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of fire extinguisher cabinet finish indicated or exposed to view.

# 1.4 QUALITY ASSURANCE

A. Coordination: Verify that extinguisher cabinets are sized to accommodate type and capacity of extinguishers indicated and provided by Owner under separate Contract.

PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. American Specialties Inc.
  - 2. Bobrick Washroom Equipment, Inc.
  - 3. Lyon Metal Products.
  - 4. J.L. Industries.
  - 5. Larsen's Manufacturing Co.
  - 6. Modern Metal Products by Muckle.
  - 7. Potter-Roemer, Inc.

# 2.2 FIRE EXTINGUISHER CABINETS

- A. General: Provide fire extinguisher cabinets of suitable size for housing fire extinguishers of types and capacities indicated.
- B. Construction: Manufacturer's standard enameled steel box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
- C. Fire-Rated Cabinets: UL-listed with UL Listing Mark with rating of wall where it is installed.
- D. Cabinet Type: Suitable for mounting conditions indicated of the following types:
  - 1. Semi-Recessed: Cabinet box (tub) semi-recessed in walls of sufficient depth to suit style of trim indicated.
- E. Trim Style: Fabricate trim in one piece with corners mitered, welded, and ground smooth.
  - 1. Exposed Trim: 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 with 2-1/2 inch backbend depth.
    - b. Trim Metal: Of same metal and finish as door.
- F. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.

- 1. Aluminum: Manufacturer's standard flush, hollow aluminum door construction.
- 2. Door Glazing: Tempered float glass complying with ASTM C 1048, Type I, Quality q3, Class as follows:
  - a. Clear glass, Class 1 (transparent).
- G. Identify fire extinguisher in cabinet with FIRE EXTINGUISHER lettering applied to door. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
  - 1. Application Process: Silk screen.
- H. Identify bracket-mounted extinguishers with FIRE EXTINGUISHER in red letter decals applied to wall surface. Use letter size, style, and location as selected by Architect.
- I. Door Style: Manufacturer's standard design.
  - 1. Full-Glass Panel: Tempered Float glass.
- J. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or door pull, exposed or concealed, and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 deg.

# 2.3 FINISHES FOR FIRE EXTINGUISHER CABINETS, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering prior to shipping.

# 2.4 STEEL FIRE EXTINGUISHER CABINET FINISHES

- A. Surface Preparation: Solvent-clean surfaces complying with SSPS-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel complying with SSPC-SP 5 (white metal blast cleaning) or SSPC-SP 8 (pickling).
- B. Baked Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturer's standard two-coat baked enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's instructions for applying and baking to achieve a minimum dry film thickness of 2.0 mils.

- 1. Color and Gloss: Manufacturer's standard color and gloss designations. Paint the following:
  - a. Interior of cabinet.
  - b. Exterior of cabinet.
- C. Clear Satin anodized finish for all trims and doors.

# 2.5 FIRE EXTINGUISHERS

- A. General: Multi-purpose dry chemical; 10 lbs. capacity; UL rating 4A-60B:C.
  - 1. Furnish (1) extinguisher per cabinet. (see plan).

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Follow manufacturer's printed instructions for installation.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights to comply with applicable regulations of governing authorities.
  - 1. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
  - 2. Fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb.

END OF SECTION 10522

# SECTION 10801 - TOILET AND BATH ACCESSORIES

# 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 toilet and bath accessory items as scheduled.
- B. Toilet compartments and related accessories are specified in Division 10.

# 1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specifications Sections.
- B. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.
- C. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.
- D. Maintenance instructions including replaceable parts and service recommendations.

### 1.4 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.
- B. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

### 1.5 PROJECT CONDITIONS

A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

# 1.6 WARRANTY

- A. Warranty: Submit a written warranty executed by mirror manufacturer, agreeing to replace any mirrors that develop visible silver spoilage defects within warranty period.
- B. Warranty Period: 15 years from date of Substantial Completion.
- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- PART 2 PRODUCTS
- 2.1 ACCEPTABLE MANUFACTURERS
  - A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering toilet accessories that may be incorporated in the Work include, but are not limited to, the following:
    - 1. A & J Washroom Accessories.
    - 2. American Specialties, Inc.
    - 3. Bobrick Washroom Equipment, Inc.
    - 4. Bradley Corporation.
    - 5. General Accessory Manufacturing Co.
    - 6. McKinney/Parker.

### 2.2 MATERIALS, GENERAL

- A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034-inch (22-gage) minimum thickness.
- B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16; Castings, ASTM B 30.
- C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 0.04-inch (20-gage) minimum. Surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A 527, G60.
- E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.
- F. Baked Enamel Finish: Factory-applied, gloss white, baked acrylic enamel coating.
- G. Mirror Glass: Nominal 6.0-mm (0.23-inch) thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating. Tempered Mirror.
- H. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

# 2.3 ACCESSORY LIST

- A. Surface-Mounted Towel Dispensers: Capacity 400 C fold or 520 multifold paper towels equal to Bobrick B-22.
- B. Toilet Tissue Dispenser: Fabricate of heavy-duty cast aluminum for mounting indicated below, size to dispense up to 6-inch-diameter core tissue rolls. No controlled delivery. To be equal to Bobrick B-2740.
  - 1. Mounting: Partition mounted (back to back mounted), two rolls for each.
- C. Grab Bars: (Stainless Steel Type) Provide grab bars with wall thickness not less than 0.05 inch (18 gage) and as follows:
  - 1. Mounting: Concealed, manufacturer's standard flanges and anchorages.
  - 2. Clearance: 1-1/2-inch clearance between wall surface and inside face of bar.
  - 3. Gripping Surfaces: Manufacturer's standard nonslip texture. (knurled surface)
  - 4. Heavy-Duty Size: Outside diameter of 1-1/4 inches.
  - 5. To be equal to Bobrick B-5806.99 x 36" & B-5806.00 x 42" with polished ends.
- D. Liquid Soap Dispenser, Horizontal-Tank Type: Fabricate for surface mounting, sized for 40-fluid-ounce minimum capacity. Provide stainless steel piston, springs, and internal parts designed to dispense soap in measured quantity by pump action. Provide cover of type 304 stainless steel in No. 4 finish, with unbreakable window-type refill indicator.
  - 1. Equip unit with push-type valve for **dispensing soap** in liquid form. To equal Bobrick B-2112.
- E. Stainless Steel Framed Mirror Units: Fabricate frame with angle shapes not less than 0.05 inch (18 gage), with square corners mitered, welded, and ground smooth. Provide in No. 4 satin polished finish. Provide tempered mirror to equal Bobrick B-2908 2060.(Tempered)
- F. Mop & Broom Holder: Provide 24" long unit with 3 holders equal to Bobrick B-223 x 24.

# 2.4 FABRICATION

- A. General: Only a maximum 1-1/2-inch-diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or

access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

- C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.
- D. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:
  - 1. Provide galvanized-steel backing sheet, not less than 0.034 inch (22 gage) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
- E. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theftproof installation, as follows:
  - 1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
- F. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

### PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F 446.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10801

# SECTION 22-05-05

#### COMMON PLUMBING REQUIREMENTS

### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

A. General project related items that apply to all Division 22 sections. The provisions included in this section are complementary to and amendatory of the Division 1 sections of these project specifications - they do not replace them.

#### 1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections apply to this section. Where conflicts may exist between Division 1 Specifications Sections and Division 22 Specification Sections, the Division 1 provisions shall take precedence except for when the Division 22 provisions expand, enhance, or extend the project, material or equipment requirements.

#### 1.03 REFERENCES

- A. FM P7825 Approval Guide; Factory Mutual.
- B. NEMA MG 1 Motors and Generators.
- C. NFPA 70 National Electrical Code.
- D. SSPC-Paint 15 Steel Joist Shop Paint; Steel Structures Painting Council.
- E. North Carolina State Building Code (All Volumes)

#### 1.04 DEFINITIONS

- A. Building Code: Collectively, the current editions of all applicable codes whose requirements must be met in order for the Building Owner to be granted an Occupancy Permit by the authorities having jurisdiction over the building. These codes shall include but not be limited to the following specific volumes as well as any additional codes or standards referenced in these publications:
  - 1. General Construction.
  - 2. Administrative.
  - 3. Accessibility.
  - 4. Plumbing.
  - 5. Mechanical.
  - 6. Electrical.
  - 7. Fire Prevention.
  - 8. Gas.
  - 9. Energy.
- B. Contractor: A licensed individual, partnership, corporation or other business entity duly licensed in the State for the trade in which he is performing work or offering to perform work. The term "Contractor" shall apply to such entity regardless of whether the entity is working as a Prime Contractor or as a Sub Contractor on the project.
  - 1. Prime Contractor: A licensed individual, partnership, corporation or other business entity duly licensed in the State for the trade in which he is performing or offering to perform work and who is awarded a contract with the Owner for work on this project.
  - 2. Sub Contractor: A licensed individual, partnership, corporation or other business entity duly licensed in the State for the trade in which he is performing or offering to perform work and who is working on the project under contract with a Prime Contractor.
- C. Collectively, the current editions of all applicable laws whose requirements must be met in order for the Building Owner to provide access to the public and to occupy and conduct business lawfully including any additional laws, codes or standards referenced in these laws. These laws include but are not limited to the following:
  - 1. Americans With Disabilities Act.
  - 2. Energy Policy Act.
- D. Applicable version of referenced standards: Wherever standards are referenced throughout these specifications and on the drawings, the version applicable will be the year that is referenced in the

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current version of the Building Codes. Where later versions have been published, but not officially adopted into the current Building Codes, the later versions do not apply to this project.

### 1.05 GENERAL PROJECT REQUIREMENTS

- A. The plans and specifications for this project are prepared to represent the general project requirements and intent. They are diagrammatic in nature and are not intended to show each and every fitting, offset, or other modifications or minor devices that may be required in the field to provide a complete system that is safe, efficient and effective in operation. Minor components or modifications that are required to provide a safe, efficient and effective system shall be included in the bid price whether or not they are specifically called for on the plans or in these specifications. It is understood that the contractors bidding this project are required to be licensed in their respective trade and are therefore knowledgeable in the trade in which they are licensed.
- B. The Contractor shall provide all contingencies and supply all tools, fixtures, transportation, etc as well as materials necessary for installation. In all its details, the work and materials shall be subject to the approval of the Architect or Engineer whose decision on all points of difference shall be final and binding on this Contractor.
- C. The Contractor shall secure and pay for all necessary approvals, permits, inspections, certificates etc. required by state or local codes or statutes, rules, or regulations and pay all fees required unless specifically noted otherwise.
- D. All work and materials are required to be in compliance with State and Local Codes. Any conflicts between the plans and State or Local Codes, Rules, Statutes, or Regulations shall be brought to the Architect's or Engineer's attention in writing immediately.
- E. Plans are diagrammatic in nature and show the general design and arrangement of the systems. They are not intended to show each and every offset or fitting required for installation of work under this contract. This Contractor, as a licensed professional, is required to be proficient and knowledgeable in his trade and is required to include all such items and contingencies in his bid. The plans are not to be scaled for rough-in dimensions nor are they to be used for shop drawings.
  - 1. Where dimensions are given on the plans, they must be verified with actual field measurements taken on the project site. This Contractor shall take such field measurements as required to coordinate the installation of his work or to prepare shop drawings.
  - 2. Slight relocation of fixtures, equipment, devices and other items may be made by this Contractor as required to fit his work to casework, trim, brick coursing, etc as long as such relocation does not interfere with work of any other Contractor.
- F. Cutting, patching and firestopping for all work under this contract will be the responsibility of the installing contractor. Holes shall be cut in walls, floors, ceilings, etc as required for installation of materials, access for installation of materials or other reasons as may require cutting by this contractor for all of his work. Patching holes and spaces around installed materials or equipment shall also be by this contractor.
  - 1. All penetrations through walls, floors, ceilings, etc shall be sealed. Leave all patched surfaces in exposed locations ready for application of final finishes. Leave patched surfaces in concealed locations neat in appearance and continuous around all sides of the penetration.
  - 2. For non rated partitions, seal with caulk, grout or other approved material that is appropriate for the substrate that the patch is matched to. For 1 hour rated partitions, seal with approved non combustible materials as listed in the State Building Code. For penetrations in partitions with fire resistance ratings in excess of 1 hour, firestop penetrations with UL listed firestopping assemblies approved for the penetrating materials as well as the partition type and materials.

# 1.06 COORDINATION OTHER DIVISIONS

A. Requirements noted in this division are intended to be supplementary to Division 1 requirements. Where Division 1 requirements exceed the requirements in this section, the Division 1 requirements shall govern. Where requirements in this section exceed Division 1 requirements, the requirements in this division shall govern. This Contractor is required to review the Division 1 requirements as well as other Divisions to allow coordination of his work with other trades.

# 1.07 PERFORMANCE REQUIREMENTS

- A. All equipment installed in fire rated walls, ceilings, or other partitions shall be listed to maintain the fire rating and shall be installed to maintain the rating.
- B. Materials (such as conduit, pipes, ducts, etc.) passing through fire rated walls, ceilings or other partitions shall be suitably firestopped using only approved materials and methods to maintain the fire rating of the assembly.
- C. Schedule all required inspections by State and Local Authorities, and make all corrections as required by such inspections.

#### 1.08 SUBMITTALS

- A. Shop Drawings: Submit shop drawings as specified in the respective specification section. When equipment, materials or systems other than the one specified are submitted, this Contractor shall be required to clearly mark differences between the items submitted and the items specified. This Contractor shall be responsible for all changes required (including but not limited to piping, wiring, mounting, clearances, etc) under this and other divisions due to the use of items other than those specified.
  - 1. Shop drawings shall be submitted electronically in pdf format. Processed shop drawings will be returned electronically in pdf format.
  - 2. Submit shop drawings in one complete package and not at intervals.
  - 3. The Contractor shall check each submittal for accuracy and completeness prior to submitting the shop drawings to the Engineer. The Contractor shall stamp and sign the documents accordingly.
  - 4. Select and identify one product for each item that submitted. Multiple products will not be considered for an item.
  - 5. Each item being submitted for review shall be clearly identified in the submittal. In the event that multiple items are cataloged in a section and a single item is not clearly identified as the one that is being submitted, the Engineer may at his discretion select any suitable item from the page that meets or exceeds the requirements for the project.

#### **1.09 QUALITY ASSURANCE**

- A. Perform in accordance with state and local building codes, laws and ordinances .
- B. Obtain and pay for all inspections, permits, and fees required for work under this contract.
- C. Substitutions: Substitutions shall be made in accordance with the procedures given in the applicable Division 1 sections. The following procedures shall supplement the procedures given in Division 1. In the event that there are not substitution procedures given in Division 1, these procedures shall be used for all Division 22 and Division 16 items.
  - 1. When equipment, materials or systems other than the one specified are submitted, this Contractor shall be required to clearly mark differences between the items submitted and the items specified. This Contractor shall be responsible for all changes required (including but not limited to piping, wiring, mounting, clearances, etc) under this and other divisions due to the use of items other than those specified. The costs for these required changes shall be borne by the Contractor making the substitution at no additional costs to the Owner. The Engineer's decision on the acceptability of substitute equipment shall be final and binding under this contract. The acceptance of substitute items shall in no way relieve the Contractor from meeting any of the project requirements.
  - 2. Items that are to be substituted for a specified item shall be equal in quality, performance, capacity, size, construction, utility requirements, appearance, etc to the item specified.
  - 3. Substitutions may be made for all items specified using the term "or equal". Where an item is specified without the use of the term "or equal" that item must be used for the project bid. No substitutions may be made for items that are specified without the "or equal" term.
  - 4. Items exceeding the performance, efficiency, quality, etc may be used when approved by the Engineer, but no additional money will be paid under the contract for such features.
  - 5. The Engineer may consider qualities and characteristics of the specified item which may or may not have been specifically called out in the schedules or specifications when evaluating the suitability of a substitute item. The Engineer's decision regarding the acceptability of substitute items shall be final and binding under this contract.

- D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience and properly licensed to perform the work.
- E. Install equipment to comply with the Americans With Disabilities Act requirements.

# 1.10 DELIVERY, STORAGE, AND PROTECTION

- A. Store materials and equipment under cover and elevated above grade until ready for installation.
- B. Deliver materials and products to project site in their original shipping containers.

### 1.11 PROJECT CONDITIONS

- A. Coordinate new work installation with size, location and installation of any existing service utilities. Field verify all locations of utilities prior to beginning work and as necessary during project progress.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

#### 1.12 WARRANTY

- A. All labor, materials, and products supplied on this project shall have a minimum of 1 year parts and labor replacement warranty.
- B. Consult individual specification sections for additional warranty requirements. Warranty requirements stated in the subsequent specifications sections are supplemental to requirements in this warranty section.
- C. Correct defective Work within a one year period after Date of Substantial Completion unless a different date is given in Division 1 specifications sections. Provide all materials, labor, supplies etc. as required to remove, disassemble, replace, reassemble, etc. the failed or otherwise defective parts that are covered under the warranty terms.
- D. Provide five year manufacturer warranty for parts of all compressors.

### 1.13 MAINTENANCE SERVICE

A. Provide service and maintenance of all equipment installed under this contract for 12 months from Date of Substantial Completion.

### PART 2 PRODUCTS

#### 2.01 GENERAL

- A. All materials and equipment supplied on this project shall comply with the applicable standards for the material or equipment where such standard exists. All items shall be listed by Underwriters Laboratories or other approved third party listing agency where a listing is available.
- B. All materials and equipment used on the project shall be new unless specifically specified otherwise in the Project Plans or Specifications.
- C. All equipment used on the project shall be the latest current production model available at the time of bidding. No discontinued, superceded, suspended production models or otherwise obsolete equipment shall be used on this project. In the event that equipment is discontinued, superceded, or production is suspended on the models bid, current production models shall be substituted and so noted on the shop drawing submittals.
- D. All materials and equipment shall be in accordance with the North Carolina State Building Code (all volumes), local codes and ordinances and shall be approved for the intended use on the project.
- E. Materials and equipment of a similar type shall be supplied by the same manufacturer where possible. Do not provide similar products from two or more manufacturers unless a highly specialized item without equal has been specified. Do not provide similar products from two or more manufacturers if the items must fit together to provide their intended function.

### PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that conditions are proper for the installation of material or equipment prior to installing such equipment. Correct (or have corrected) any unsatisfactory conditions prior to installing materials or equipment.

#### 3.02 INSTALLATION

- A. Install materials and equipment in accordance with manufacturer's instructions and recommendations. Supply additional materials and labor as may be recommended by the manufacturer or where required for compliance with codes for the best installation of the materials or equipment whether such items are specifically called for otherwise in the project plans or specifications.
- B. Unless specifically shown otherwise on the plans, install all piping, concealed from view of finished spaces.
- C. Coordinate rough-in of plumbing fixtures, thermostats, etc with the requirements of the Americans With Disabilities Act requirements.
- D. Install all equipment, materials, components, etc. in accordance with the applicable Building Code requirements and Building Related Laws. The project plans and specifications are prepared with the knowledge that bidders must be licensed contractors in their respective trade, and as such, are required to be knowledgeable of code and law requirements. All materials, components, accessories or other appurtenances required by code or law for a proper, safe, efficient, and legal installation shall be included in the project base bid price. Any and all work, materials, equipment, supplies or other items made necessary by code or law requirements shall be included in the project base bid price or not said items are specifically called for on the project plans or in the specifications. No additional charges shall be allowed to the contract for items that are legally required by such code or laws.
- E. Provide all cutting and patching as required for installation of materials or equipment under this contract except where specifically noted otherwise on the plans.
- F. Where applicable, provide all demolition, disassembly, removal, transportation, and legal disposal of existing items that are not being reused or salvaged.
- G. Label all equipment and piping installed as well as all existing equipment and piping that remain on this project. Label equipment with engraved laminated phenolic plates secured to the exterior of the equipment. Label valves with brass valve tags and provide a Valve Tag Schedule. Label above ground pipes with the medium in the pipe and the flow direction.
- H. Identify underground piping by installing a plastic tape with indicator wire approximately 6" above the pipe.
- I. Provide all trenching and backfilling required for installation of work in this project. Backfill in 8" lifts and compact to 95% proctor unless a different compaction level is listed on the plan or in the earthwork sections of the specifications. Seed and straw disturbed grass areas. Patch disturbed paved areas equal to the adjacent paving. Provide new mulch for disturbed mulched areas.

#### 3.03 INTERFACE WITH OTHER WORK

- A. This Contractor shall coordinate his work with that of all other Contractors on the project and shall consult the drawings and specifications of the other trades to determine the nature and effect of work by others. This Contractor shall be responsible for all his work fitting in place with in an approved manner, and shall consult with others as required for drawings, dimensions, elevations, actual building measurements, etc. as necessary to insure that his work does fit properly and does not conflict with other trades.
- B. In the event that interferences develop, this Contractor shall cooperate with others to eliminate the interference. Should pipes, ductwork, equipment or other items have to be relocated, the Architect's or Engineer's decision will be the final authority as to which Contractor shall relocate his work.
- C. Coordinate voltage and current characteristics of all equipment installed with other Contractors, Subcontractors or Owner on the project.
- D. Coordinate the power connections for all equipment installed by this Contractor with other Contractors on the project.
- E. Consult the kitchen equipment shop drawings to determine exact rough-in and connection locations for kitchen equipment.
- F. Do not route pipes over electrical panelboards
- G. Do not route pipes through ductwork.

### 3.04 FIELD QUALITY CONTROL

- A. Thoroughly inspect equipment installed on this project for proper installation prior to start-up of the equipment.
- B. Adjust and test each piece of equipment to insure that all operating and safety controls are functioning safely, properly and efficiently. Replace any defective items that would prevent such operations.

#### 3.05 STARTING EQUIPMENT AND SYSTEMS

- A. Adjust for proper operation within manufacturer's published tolerances.
- B. Demonstrate proper operation of systems to Owner's designated representative and instruct him in the proper maintenance procedures of each system.

#### 3.06 ADJUSTING

A. Adjust equipment for smooth, quiet, safe and efficient operation.

#### 3.07 CLEANING

- A. Clean all equipment, piping, labels, mechanical rooms, attics etc prior to project closeout. All construction debris is to be removed and properly disposed of. Remove all stains and drips from the equipment and from the building.
- B. Protect installed material and equipment from subsequent construction operations.
- C. Do not permit traffic over unprotected floor surface.

# END OF SECTION

### SECTION 22-05-53

# IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

# PART 1 GENERAL

### **1.01 SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.
- E. Ceiling tacks.

#### 1.02 REFERENCE STANDARDS

- A. ASME A13.1 Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers (ANSI/ASME A13.1).
- B. ASTM D709 Standard Specification for Laminated Thermosetting Materials.

#### 1.03 SUBMITTALS

- A. List: Submit list of wording, symbols, letter size, and color coding for identification.
- B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Project Record Documents: Record actual locations of tagged valves.

#### PART 2 PRODUCTS

#### 2.01 IDENTIFICATION APPLICATIONS

- A. Heat Transfer Equipment: Nameplates.
- B. Piping: Pipe markers.
- C. Pumps: Nameplates.
- D. Small-sized Equipment: Tags.
- E. Tanks: Nameplates.
- F. Valves: Tags and ceiling tacks where located above lay-in ceiling.

#### 2.02 NAMEPLATES

- A. Manufacturers:
  - 1. Brimar Industries, Inc.: www.pipemarker.com.
  - 2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
  - 3. Seton Identification Products: www.seton.com.
- B. Description: Laminated three-layer plastic with engraved letters.
  - 1. Letter Color: White.
  - 2. Letter Height: 1/4 inch.
  - 3. Background Color: Black.
  - 4. Plastic: Conform to ASTM D709.

#### 2.03 TAGS

- A. Manufacturers:
  - 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
  - 2. Brady Corporation: www.bradycorp.com.
  - 3. Brimar Industries, Inc.: www.pipemarker.com.
  - 4. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
  - 5. Seton Identification Products: www.seton.com.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.
- E. Chart: Typewritten letter size list in anodized aluminum frame.

### 2.04 STENCILS

- A. Manufacturers:
  - 1. Brady Corporation: www.bradycorp.com.
  - 2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
  - 3. Seton Identification Products: www.seton.com.
- B. Stencils: With clean cut symbols and letters of following size:
  - 1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
  - 2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
  - 3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
  - 4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
  - 5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
  - 6. Ductwork and Equipment: 2-1/2 inch high letters.
- C. Stencil Paint: Semi-gloss enamel, colors conforming to ASME A13.1.

### 2.05 PIPE MARKERS

- A. Manufacturers:
  - 1. Brady Corporation: www.bradycorp.com.
  - 2. Brimar Industries, Inc.: www.pipemarker.com.
  - 3. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
  - 4. MIFAB, Inc.: www.mifab.com.
  - 5. Seton Identification Products: www.seton.com.
- B. Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- F. Color code as follows:
  - 1. Potable: Green with white letters.
  - 2. Compressed Air: Blue with white letters.
  - 3. Vacuum: Yellow with white letters

#### 2.06 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
  - 1. Plumbing Valves: Green.

# PART 3 EXECUTION

### 3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Degrease and clean surfaces for stencil painting.

### 3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

#### IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- J. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

### **END OF SECTION**

# SECTION 22-07-19 PLUMBING PIPING INSULATION

#### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Piping insulation.
- B. Jackets and accessories.

### 1.02 RELATED REQUIREMENTS

A. Section 22-10-05 - Plumbing Piping: Placement of hangers and hanger inserts.

#### 1.03 REFERENCE STANDARDS

- A. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].
- C. ASTM C177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
- D. ASTM C195 Standard Specification for Mineral Fiber Thermal Insulating Cement.
- E. ASTM C449 Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
- F. ASTM C547 Standard Specification for Mineral Fiber Pipe Insulation.
- G. ASTM C552 Standard Specification for Cellular Glass Thermal Insulation.
- H. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- I. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials.
- J. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc..

#### 1.04 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

### 1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

#### PART 2 PRODUCTS

#### 2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

#### 2.02 GLASS FIBER

- A. Manufacturers:
  - 1. CertainTeed Corporation: www.certainteed.com.
  - 2. Johns Manville Corporation: www.jm.com.

- 3. Knauf Insulation: www.knaufusa.com.
- 4. Owens Corning Corporation: www.ocbuildingspec.com.
- B. Insulation: ASTM C547; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
  - 1. 'K' Value: ASTM C177, 0.23 at 75 degrees F.
  - 2. Maximum Service Temperature: 220 degrees F.
  - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- G. Fibrous Glass Fabric:
  - 1. Cloth: Untreated; 9 oz/sq yd weight.
  - 2. Weave: 5x5.
- H. Indoor Vapor Barrier Finish:
  - 1. Cloth: Untreated; 9 oz/sq yd weight.
  - 2. Vinyl emulsion type acrylic, compatible with insulation, black color.
- I. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- J. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- K. Insulating Cement: ASTM C449.

# 2.03 CELLULAR GLASS

- A. Insulation: ASTM C552, Type II.
  - 1. Apparent Thermal Conductivity; 'K' value: Grade 6, 0.35 at 100 degrees F.
  - 2. Service Temperature: Up to 800 degrees F.
  - 3. Water Vapor Permeability: 0.005 perm inch.
  - 4. Water Absorption: 0.5 percent by volume, maximum.

# 2.04 JACKETS

- A. PVC Plastic.
  - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum Service Temperature: 0 degrees F.
    - b. Maximum Service Temperature: 150 degrees F.
    - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
    - d. Thickness: 10 mil.
    - e. Connections: Brush on welding adhesive.
  - 2. Covering Adhesive Mastic: Compatible with insulation.
- B. Canvas Jacket: UL listed.
  - 1. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
  - 2. Lagging Adhesive: Compatible with insulation.
- C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
  - 1. Thickness: 0.016 inch sheet.
  - 2. Finish: Smooth.
  - 3. Joining: Longitudinal slip joints and 2 inch laps.
  - 4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
  - 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

# PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
  - 1. Finish insulation systems that are exposed in Mechanical Rooms or other locations with canvas or fiberglass cloth covered with mastic to create a durable firm finish.
  - 2. Paint finish to Owner's color keyed identification system.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
  - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- H. Glass fiber insulated pipes conveying fluids above ambient temperature:
  - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
  - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with PVC fitting covers.
- I. Inserts and Shields:
  - 1. Application: Piping 1-1/2 inches diameter or larger.
  - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  - 3. Insert Location: Between support shield and piping and under the finish jacket.
  - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  - 5. Insert material: Hydrous calcium silicate insulation, cellular glass insulation, or other heavy density insulating material suitable for the planned temperature range.
- J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07-84-00.
- K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.
- L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- M. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

### 3.03 SCHEDULES

- A. Plumbing Systems:
  - 1. Domestic Cold Water Supply:
    - a. Glass Fiber Insulation:

- Pipe Size Range: 1/2"-1" inch.
   (a) Thickness: 1/2 inch.
- 2) Pipe Size Range: 1-1/4" 3" inch.
  (a) Thickness: 1 inch.
- 2. Domestic Hot Water Supply:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: 1/2"-1" inch.
      - (a) Thickness: 1/2 inch.
    - 2) Pipe Size Range: 1-1/4" 3" inch.
    - (a) Thickness: 1 inch.
- 3. Roof Drain Bodies:
  - a. Glass Fiber Insulation: 1" wall thickness with all service jacket.
- 4. Roof Drainage Above Grade:
  - a. Glass Fiber Insulation: 1" wall thickness with all service jacket.

# END OF SECTION

# SECTION 22-10-05 PLUMBING PIPING

#### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Pipe, pipe fittings, valves, and connections for piping systems.
  - 1. Sanitary sewer.
  - 2. Non-medical vacuum piping.
  - 3. Domestic water.
  - 4. Non-medical compressed air.
  - 5. Flanges, unions, and couplings.
  - 6. Pipe hangers and supports.
  - 7. Valves.
  - 8. Check.
  - 9. Water pressure reducing valves.
  - 10. Relief valves.

#### **1.02 RELATED REQUIREMENTS**

A. Section 22-07-19 - Plumbing Piping Insulation.

#### 1.03 REFERENCE STANDARDS

- A. ANSI Z21.22 American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.
- B. ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers (ANSI B16.18).
- C. ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; The American Society of Mechanical Engineers.
- D. ASME B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes; The American Society of Mechanical Engineers.
- E. ASME B31.9 Building Services Piping; The American Society of Mechanical Engineers (ANSI/ASME B31.9).
- F. ASME BPVC-IV Boiler and Pressure Vessel Code, Section IV Rules for Construction of Heating Boilers; The American Society of Mechanical Engineers.
- G. ASME BPVC-IX Boiler and Pressure Vessel Code, Section IX Welding, Brazing, and Fusing Qualifications; The American Society of Mechanical Engineers.
- H. ASSE 1003 Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems; The American Society of Sanitary Engineering.
- I. ASTM B42 Standard Specification for Seamless Copper Pipe, Standard Sizes.
- J. ASTM B88 Standard Specification for Seamless Copper Water Tube.
- K. ASTM B88M Standard Specification for Seamless Copper Water Tube (Metric).
- L. ASTM B813 Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
- M. ASTM B828 Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
- N. ASTM D2564 Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
- O. ASTM D2665 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- P. ASTM D2855 Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
- Q. ASTM D3034 Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- R. ASTM F 708 Standard Practice for Design and Installation of Rigid Pipe Hangers.
- S. AWS A5.8M/A5.8 Specification for Filler Metals for Brazing and Braze Welding; American Welding Society.
- T. AWWA C550 Protective Interior Coatings for Valves and Hydrants; American Water Works Association.
- U. AWWA C651 Disinfecting Water Mains; American Water Works Association (ANSI/AWWA C651).
- V. ICC-ES AC01 Acceptance Criteria for Expansion Anchors in Masonry Elements.
- W. ICC-ES AC106 Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.
- X. ICC-ES AC193 Acceptance Criteria for Mechanical Anchors in Concrete Elements.
- Y. ICC-ES AC308 Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
- Z. MSS SP-58 Pipe Hangers and Supports Materials, Design, Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..
- AA. MSS SP-67 Butterfly Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..
- AB. MSS SP-78 Cast Iron Plug Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..
- AC. MSS SP-80 Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..
- AD. MSS SP-85 Cast Iron Globe & Angle Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..
- AE. MSS SP-110 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..
- AF. NSF 61 Drinking Water System Components Health Effects.
- AG. NSF 372 Drinking Water System Components Lead Content.

# 1.04 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- B. Project Record Documents: Record actual locations of pipe and valves.

# 1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.
- D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
- E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.
- F. Conform to applicable water supplier's requirements for type and installation of backflow prevention devices.

# 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

## 1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

# PART 2 PRODUCTS

#### 2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

#### 2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D2665.
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

#### 2.03 SANITARY SEWER PIPING, ABOVE GRADE

- A. PVC Pipe: ASTM D2665.
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

## 2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Pipe: ASTM B42, annealed.
  - 1. Fittings: ASME B16.26, cast bronze.
  - 2. Joints: Flared.

# 2.05 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
  - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
  - 2. Joints: ASTM B 32, alloy Sn95 Tin-Antimony solder. (For piping up to 1-1/4" nominal diameter.)
  - 3. Joints: AWS A5.8, Silver alloy brazing filler BAg1. (For piping 1-1/2" nominal diameter and larger.)

#### 2.06 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches and Under:
  - 1. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 1 Inch:
  - 1. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

#### 2.07 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
  - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
  - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
    - a. Do not use fabric, plastic, or steel strapping to support pipes. These methods may be used as temporary supports but must be removed and replace with hangers prior to completion of the project.
  - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
  - 4. Vertical Pipe Support: Steel riser clamp.
  - 5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
- B. Plumbing Piping Drain, Waste, and Vent:
  - 1. Conform to ASME B31.9.
  - 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
  - 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
  - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
  - 6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
  - 7. Vertical Support: Steel riser clamp.

- 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- 9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Plumbing Piping Water:
  - 1. Conform to ASME B31.9.
  - 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
  - 3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
  - 4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
  - 5. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
  - 6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
  - 7. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
  - 8. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
  - 9. Vertical Support: Steel riser clamp.
  - 10. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  - 11. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
  - 12. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
  - 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
  - 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
  - 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
  - 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
  - 5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
  - 6. Other Types: As required.

#### 2.08 GLOBE VALVES

- A. Up To and Including 3 Inches:
  - 1. MSS SP-80, Class 125, bronze body, bronze trim, handwheel, bronze disc, solder or threaded ends as appropriate for the application.
- B. 2 Inches and Larger:
  - 1. MSS SP-85, Class 125, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

# 2.09 BALL VALVES

- A. Manufacturers:
  - 1. Conbraco Industries, Inc; \_\_\_\_\_: www.apollovalves.com.
  - 2. Grinnell Products, a Tyco Business: www.grinnell.com.
  - 3. Nibco, Inc; \_\_\_\_: www.nibco.com.
  - 4. Milwaukee Valve Company; \_\_\_\_\_: www.milwaukeevalve.com.
- B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder, threaded, or grooved ends with union.

# 2.10 PLUG VALVES

- A. Manufacturers:
  - 1. Apollo Valve.
  - 2. Conbraco Industries.
  - 3. Nibco, Inc.
  - 4. Milwaukee Valve Company.
- B. Construction 2-1/2 Inches and Larger: MSS SP-78, 175 psi CWP, cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

#### 2.11 BUTTERFLY VALVES

- A. Manufacturers:
  - 1. Hammond Valve: www.hammondvalve.com.
  - 2. Crane Co.: www.cranecpe.com.
  - 3. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Construction 1-1/2 Inches and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.
- C. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

## 2.12 SWING CHECK VALVES

- A. Manufacturers:
  - 1. Hammond Valve: www.hammondvalve.com.
  - 2. Nibco, Inc: www.nibco.com.
  - 3. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Up to 3 Inches:
  - 1. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

#### 2.13 SPRING LOADED CHECK VALVES

- A. Manufacturers:
  - 1. Hammond Valve: www.hammondvalve.com.
  - 2. Crane Co.: www.cranecpe.com.
  - 3. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

## 2.14 WATER PRESSURE REDUCING VALVES

- A. Manufacturers:
  - 1. Amtrol Inc: www.amtrol.com.
  - 2. Cla-Val Co: www.cla-val.com.
  - 3. Watts Regulator Company: www.wattsregulator.com.
- B. Up to 2 Inches:
  - 1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
- C. Over 2 Inches:
  - 1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

# 2.15 RELIEF VALVES

- A. Pressure Relief:
  - 1. Manufacturers:
    - a. Cla-Val Co: www.cla-val.com.
    - b. Henry Technologies: www.henrytech.com.
    - c. Watts Regulator Company: www.wattsregulator.com.
  - 2. ANSI Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure Relief:
  - 1. Manufacturers:
    - a. Cla-Val Co: www.cla-val.com.
    - b. Henry Technologies: www.henrytech.com.
    - c. Watts Regulator Company: www.wattsregulator.com.
  - ANSI Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

# PART 3 EXECUTION

# 3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

# 3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

# 3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Install piping to allow removal of equipment without requiring the removal of pipe sections.
- F. Group piping whenever practical at common elevations.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- I. Provide access where valves and fittings are not exposed.
- J. Establish elevations of buried piping outside the building to ensure not less than one and one half ft of cover.
- K. Install vent piping penetrating roofed areas to maintain integrity of roof assembly; .
  - 1. Single-ply roofs: G.C. will supply and install flashing materials on vent piping.
  - 2. Built-up roofs: Install sheet lead slashing assemblies or other approved flashing materials.
  - 3. Metal Roofs: G.C. to supply flashing assemblies. Install under this contract.
  - 4. Shingled Roofs: Provide flashing assemblies.
- L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to the weld.
- M. Provide support for utility meters in accordance with requirements of utility companies.
- N. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- O. Excavate in accordance with Division I Sections for work of this Section.
- P. Backfill in accordance with Division I Sections for work of this Section.
  - 1. If not stated backfill in 8" lifts and compact to 95% compaction in unpaved areas and 98% compaction in paved areas.
  - 2. Seed and straw disturbed areas upon completion of backfill.
- Q. Install bell and spigot pipe with bell end upstream.
- R. Ensure all drain piping is sloped with no bellys or humps. Sections of piping found to be pooling water must be exposed and repaired and all finishes restored at contractor's expense.
- S. Install valves with stems upright or horizontal, not inverted.
- T. Install valves at no more than 45 degrees from the upright position.
- U. Support cast iron drainage piping at every joint.
- V. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- W. Install water piping to ASME B31.9.
- X. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

- Y. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- Z. Sleeve pipes passing through partitions, walls and floors. Seal airt and water tight between the sleeve and pipe with approved sealant material.
- AA. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.9.
  - 2. Support horizontal piping as scheduled.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 7. Provide copper plated hangers and supports for copper piping.
  - 8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- AB. Paint indoor gas piping with two coats of glossy enamel paint. The color shall be safety yellow unless noted or directed otherwise by the Architect or Engineer.
- AC. Paint gas piping that is exposed to the weather with two coats of oil based enamel paint. The color shall be safety yellow unless noted or directed otherwise by the Architect or Engineer.

# 3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Install globe or ball valves for throttling, bypass, or manual flow control services.
- E. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.
- F. Provide spring loaded check valves on discharge of water pumps.
- G. Provide flow controls in water recirculating systems where indicated.

# 3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope unless noted otherwise.
  - 1. Drain piping 2" and smaller shall be sloped at 1/4 inch per foot.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

# 3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

# 3.07 SCHEDULES

A. Pipe Hanger Spacing:

- 1. Metal Piping:
  - a. Pipe size: 1/2 inches to 1-1/4 inches:
    - 1) Maximum hanger spacing: 6.5 ft.
    - 2) Hanger rod diameter: 3/8 inches.
  - b. Pipe size: 1-1/2 inches to 2 inches:
    - 1) Maximum hanger spacing: 10 ft.
    - 2) Hanger rod diameter: 3/8 inch.
  - c. Pipe size: 2-1/2 inches to 3 inches:
    - 1) Maximum hanger spacing: 10 ft.
    - 2) Hanger rod diameter: 1/2 inch.
  - d. Pipe size: 4 inches to 6 inches:
    - 1) Maximum hanger spacing: 10 ft.
    - 2) Hanger rod diameter: 5/8 inch.
- 2. Plastic Piping:
  - a. All Sizes:
    - 1) Maximum hanger spacing: 6 ft.
    - 2) Hanger rod diameter: 3/8 inch.

# SECTION 22-10-06 PLUMBING PIPING SPECIALTIES

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Drains.
- B. Floor drains.
- C. Cleanouts.
- D. Hose bibbs.
- E. Hydrants.
- F. Refrigerator valve and recessed box.
- G. Backflow preventers.
- H. Water hammer arrestors.
- I. Mixing valves.

# 1.02 RELATED REQUIREMENTS

- A. Section 22-10-05 Plumbing Piping.
- B. Section 22-40-00 Plumbing Fixtures.

## 1.03 REFERENCE STANDARDS

- A. ASME A112.6.3 Floor and Trench Drains; The American Society of Mechanical Engineers.
- B. ASSE 1011 Hose Connection Vacuum Breakers; American Society of Sanitary Engineering (ANSI/ASSE 1011).
- C. ASSE 1013 Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; American Society of Sanitary Engineering.
- D. ASSE 1019 Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; American Society of Sanitary Engineering (ANSI/ASSE 1019).
- E. NSF 61 Drinking Water System Components Health Effects.
- F. NSF 372 Drinking Water System Components Lead Content.
- G. PDI-WH 201 Water Hammer Arresters; Plumbing and Drainage Institute.

#### 1.04 SUBMITTALS

- A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

# 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.
  - 1. Two loose keys for outside hose bibs.

# PART 2 PRODUCTS

#### 2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

#### 2.02 DRAINS

#### 2.03 ROOF DRAINS:

A. Roof drains will be supplied and installed by the General Contractor. Connection to the drain with a flexible connector will be required under this section.

#### 2.04 ROOF OVERFLOW DRAINS:

A. Overflow drains will be furnished and installed by the General Contractor. Connection to the drain with a flexible connector will be required under this section.

#### 2.05 DOWNSPOUT NOZZLES:

- A. Bronze round with offset bottom section.
- B. Internal screen assembly for pipe sizes larger than 2"

#### 2.06 FLOOR DRAINS:

- A. Floor Drain for "finished" areas: Equal to Zurn ZN415 with square Nickalloy top.
  - 1. ASME A112.21.1M; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and square, adjustable nickel-bronze strainer.

#### 2.07 FLOOR SINKS

A. Rectangular cast iron with acid resistant enamel interior coating, aluminum dome strainer and nickaloy top grate.

# 2.08 CLEANOUTS

- A. Cleanouts at Interior Finished Floor Areas:
  - 1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and square gasketed depressed cover to accept floor finish in finished floor areas.

# 2.09 HOSE BIBBS

- A. Interior Hose Bibbs:
  - 1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in conformance with ASSE 1011.

# 2.10 HYDRANTS

- A. Wall Hydrants:
  - 1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate hose thread spout, handwheel, and integral vacuum breaker.

# 2.11 REFRIGERATOR VALVE AND RECESSED BOX

A. Description: Plastic preformed rough-in box with brass valves with wheel handle, slip in finishing cover.

# 2.12 BACKFLOW PREVENTERS

- A. Reduced Pressure Backflow Preventers:
  - 1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

#### 2.13 WATER HAMMER ARRESTORS

- A. Water Hammer Arrestors:
  - 1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

#### 2.14 MIXING VALVES

#### 2.15 THERMOSTATIC MIXING VALVES:

- A. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
- B. Accessories:
  - 1. Check valve on inlets.
  - 2. Volume control shut-off valve on outlet.
  - 3. Stem thermometer on outlet.
  - 4. Strainer stop checks on inlets.
- C. Cabinet: 16 gage, 0.0598 inch prime coated steel, for recessed mounting with keyed lock.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in a 12"x12"x6" minimum concrete pad flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- F. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks or washing machine outlets.

# SECTION 22-30-00 PLUMBING EQUIPMENT

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Water heaters.
- B. Compression tanks.
- C. Pumps.
  - 1. Circulators.

#### 1.02 REFERENCE STANDARDS

- A. UL 174 Standard for Household Electric Storage Tank Water Heaters; Underwriters Laboratories Inc..
- B. UL 1453 Standard for Electric Booster and Commercial Storage Tank Water Heaters; Underwriters Laboratories Inc..

#### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

#### 1.04 SUBMITTALS

- A. Product Data:
  - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
  - 2. Indicate pump type, capacity, power requirements.
  - 3. Provide electrical characteristics and connection requirements.
- B. Shop Drawings:
  - 1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

# 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

#### 1.06 CERTIFICATIONS

- A. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

# 1.08 WARRANTY

A. Provide five year manufacturer warranty for water heater tanks.

# PART 2 PRODUCTS

# 2.01 WATER HEATER MANUFACTURERS

- A. A.O. Smith Water Products Co: www.hotwater.com.
- B. Bock Water Heaters, Inc: www.bockwaterheaters.com.
- C. Rheem Manufacturing Company: www.rheem.com.

#### 2.02 RESIDENTIAL ELECTRIC WATER HEATERS

A. Type: Automatic, electric, vertical storage.

- B. Performance:
  - 1. As scheduled on plans.
- C. Electrical Characteristics:
  - 1. As scheduled on plans.
- D. Tank: Glass lined welded steel, thermally insulated with one inch thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.
- E. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box and operating light. Wire double element units so elements do not operate simultaneously.
- F. Accessories: Provide:
  - 1. Water Connections: Brass.
  - 2. Dip tube: Brass.
  - 3. Drain Valve.
  - 4. Anode: Magnesium

# 2.03 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Manufacturers:
  - 1. Amtrol Inc: www.amtrol.com.
  - 2. ITT Bell & Gossett: www.bellgossett.com.
  - 3. Taco, Inc: www.taco-hvac.com.
- B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible diaphragm sealed into tank, and steel legs or saddles. NSF listed.
- C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psig.

# 2.04 IN-LINE CIRCULATOR PUMPS

- A. Manufacturers:
  - 1. Armstrong Pumps Inc: www.armstrongpumps.com.
  - 2. ITT Bell & Gossett: www.bellgossett.com.
  - 3. Taco, Inc: www.taco-hvac.com.
- B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.
- G. Performance:
  - 1. As scheduled on plans.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Pipe P&T relief valve to floor or exterior as appropriate for the job condition.
- C. Coordinate with plumbing piping and related fuel piping work to achieve operating system.
- D. Pumps:
  - 1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
  - 2. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

3. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

# SECTION 22-40-00 PLUMBING FIXTURES

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Water closets.
- B. Lavatories.
- C. Sinks.
- D. Electric water coolers.

#### 1.02 RELATED REQUIREMENTS

- A. Section 22-10-05 Plumbing Piping.
- B. Section 22-10-06 Plumbing Piping Specialties.
- C. Section 22-30-00 Plumbing Equipment.

#### 1.03 REFERENCE STANDARDS

- A. ASHRAE Std 18 Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration.
- B. ASME A112.6.1M Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers.
- C. ASME A112.18.1 Plumbing Supply Fittings; The American Society of Mechanical Engineers.
- D. ASME A112.19.1 Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures
- E. ASME A112.19.2 Ceramic Plumbing Fixtures; The American Society of Mechanical Engineers.
- F. ASME A112.19.3 Stainless Steel Plumbing Fixtures (Designed for Residential Use); The American Society of Mechanical Engineers.
- G. NSF 61 Drinking Water System Components Health Effects.
- H. NSF 372 Drinking Water System Components Lead Content.

#### 1.04 SUBMITTALS

- A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- B. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

#### 1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

#### 1.08 WARRANTY

A. Provide five year manufacturer warranty for electric water cooler.

# PART 2 PRODUCTS

#### 2.01 GENERAL

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

#### 2.02 TANK TYPE WATER CLOSETS

- A. Tank Type Water Closet Manufacturers:
  - 1. American Standard, Inc: www.americanstandard-us.com.
  - 2. Eljer.
  - 3. Kohler Company: www.kohler.com.
  - 4. Zurn Industries, Inc: www.zurn.com.
- Bowl: ASME A112.19.2; floor mounted, vitreous china reverse trap, close-coupled closet combination with regular rim, insulated vitreous china closet tank with fittings and lever flushing valve, bolt caps.
  Water Consumption: Maximum 1.6 gallons per flush.
- C. Fixture to be as specified on plan.
- D. Seat Manufacturers:
  - 1. American Standard, Inc: www.americanstandard-us.com.
  - 2. Bemis Manufacturing Company: www.bemismfg.com.
  - 3. Church Seat Company: www.churchseats.com.
  - 4. Olsonite: www.olsonite.com.
- E. Seat: Solid white plastic, open front, brass bolts, without cover.

# 2.03 LAVATORIES

- A. Lavatory Manufacturers:
  - 1. American Standard, Inc: www.americanstandard-us.com.
  - 2. Eljer.
  - 3. Kohler Company: www.kohler.com.
  - 4. Zurn Industries, Inc: www.zurn.com.
- B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, 19 by 19 inch minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.
  1. Drilling Centers: 4 inch.
- C. Cast Iron Wall Hung Basin: ASME A112.19.1; porcelain enamelled cast iron wall-hung lavatory, 19 by 19 inch minimum, with 4 inch high back, drillings on 4 inch centers, rectangular basin with splash lip, front overflow, and soap depression.
- D. Fixture to be as scheduled on plan and furnished with wall bracket faucet, waste outlet, tailpiece, ptrap water supply tubing and stops.
- E. Supply Faucet Manufacturers:
  - 1. Chicago Faucets
  - 2. Delta Faucets
  - 3. Sloan
- F. Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting with open grid strainer, water economy aerator with maximum flow of 0.5 gallon per minute (low-flow), single lever handle.
- G. Accessories:
  - 1. Chrome plated 17 gage, 0.0538 inch brass P-trap with clean-out plug and arm with escutcheon.
  - 2. Offset waste with perforated open strainer.
  - 3. Screwdriver stops.
  - 4. Rigid supplies.

# 2.04 SINKS

- A. Sink Manufacturers:
  - 1. American Standard, Inc: www.americanstandard-us.com.
  - 2. Eljer.

- 3. Kohler Company: www.kohler.com.
- B. Single Compartment Bowl: ASME A112.19.3; x by x by x inch outside dimensions 20 gage, 0.0359 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
  - 1. Drain: 1-1/2 inch chromed brass drain.
  - 2. Drain: 3-1/2 inch crumb cup and tailpiece.
- C. Fixture to be as specified on plan.
- D. Trim:
  - 1. Trim: ASME A112.18.1M; chrome plated brass supply with swing spout, water economy aerator with maximum 2.2 gpm flow, single lever handle.

# 2.05 ELECTRIC WATER COOLERS

- A. Electric Water Cooler Manufacturers:
  - 1. Elkay Manufacturing Company: www.elkay.com.
  - 2. Haws Corporation: www.hawsco.com.
  - 3. Oasis, a Lynn Tilton Company: www.oasiscoolers.com
- B. Fixture to be as specified on plan.
- C. Fountain:
  - 1. Water Cooler: Electric, mechanically refrigerated; surface handicapped mounted; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
  - 2. Capacity: 8 gallons per minute of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
  - 3. Electrical: 115 V, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.
  - 4. Cane Detection Apron: Installed to lower the high-bowl side body to cane detection maximum height.

#### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

# 3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

#### 3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid brass supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports and bolts.
- E. Seal fixtures to wall and floor surfaces (as applicable) with mildew resistant silicone based sealant to match the fixture color. Do not use clear sealant to seal plumbing fixtures.

#### 3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

#### 3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

A. Clean plumbing fixtures and equipment.

# 3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

# 3.08 SCHEDULES

- A. Fixture Heights: Unless detailed otherwise on the plan, install fixtures to heights above finished floor as indicated.
  - 1. Lavatory:
    - a. Standard: 31 inches to top of basin rim.
    - b. Accessible: 34 inches to top of basin rim.
  - 2. Drinking Fountain & Water Cooler:
    - a. Standard Adult: 40 inches to top of basin rim.
    - b. Accessible: 36 inches to top of spout.
- B. Fixture Rough-In
  - 1. Fixture rough-ins to be as specified on plan in the "PLUMBING FIXTURE CONNECTION SCHEDULE".
  - 2. Shower:

## SECTION 23-05-05

#### COMMON MECHANICAL REQUIREMENTS

# PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. General project related items that apply to all Division 23 sections. The provisions included in this section are complementary to and amendatory of the Division 1 sections of these project specifications - they do not replace them.

#### 1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections apply to this section. Where conflicts may exist between Division 1 Specifications Sections and Division 23 Specification Sections, the Division 1 provisions shall take precedence except for when the Division 23 provisions expand, enhance, or extend the project, material or equipment requirements.

#### 1.03 REFERENCES

- A. FM P7825 Approval Guide; Factory Mutual .
- B. NEMA MG 1 Motors and Generators .
- C. NFPA 70 National Electrical Code.
- D. SSPC-Paint 15 Steel Joist Shop Paint; Steel Structures Painting Council.
- E. North Carolina State Building Code (All Volumes)

#### 1.04 DEFINITIONS

- A. Building Code: Collectively, the current editions of all applicable codes whose requirements must be met in order for the Building Owner to be granted an Occupancy Permit by the authorities having jurisdiction over the building. These codes shall include but not be limited to the following specific volumes as well as any additional codes or standards referenced in these publications:
  - 1. General Construction.
  - 2. Administrative.
  - 3. Accessibility.
  - 4. Plumbing.
  - 5. Mechanical.
  - 6. Electrical.
  - 7. Fire Prevention.
  - 8. Gas.
  - 9. Energy.
- B. Contractor: A licensed individual, partnership, corporation or other business entity duly licensed in the State for the trade in which he is performing work or offering to perform work. The term "Contractor" shall apply to such entity regardless of whether the entity is working as a Prime Contractor or as a Sub Contractor on the project.
  - 1. Prime Contractor: A licensed individual, partnership, corporation or other business entity duly licensed in the State for the trade in which he is performing or offering to perform work and who is awarded a contract with the Owner for work on this project.
  - 2. Sub Contractor: A licensed individual, partnership, corporation or other business entity duly licensed in the State for the trade in which he is performing or offering to perform work and who is working on the project under contract with a Prime Contractor.
- C. Collectively, the current editions of all applicable laws whose requirements must be met in order for the Building Owner to provide access to the public and to occupy and conduct business lawfully including any additional laws, codes or standards referenced in these laws. These laws include but are not limited to the following:
  - 1. Americans With Disabilities Act.
  - 2. Energy Policy Act.
- D. Applicable version of referenced standards: Wherever standards are referenced throughout these specifications and on the drawings, the version applicable will be the year that is referenced in the

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current version of the Building Codes. Where later versions have been published, but not officially adopted into the current Building Codes, the later versions do not apply to this project.

# 1.05 GENERAL PROJECT REQUIREMENTS

- A. The plans and specifications for this project are prepared to represent the general project requirements and intent. They are diagrammatic in nature and are not intended to show each and every fitting, offset, or other modifications or minor devices that may be required in the field to provide a complete system that is safe, efficient and effective in operation. Minor components or modifications that are required to provide a safe, efficient and effective system shall be included in the bid price whether or not they are specifically called for on the plans or in these specifications. It is understood that the contractors bidding this project are required to be licensed in their respective trade and are therefore knowledgeable in the trade in which they are licensed.
- B. The Contractor shall provide all contingencies and supply all tools, fixtures, transportation, etc as well as materials necessary for installation. In all its details, the work and materials shall be subject to the approval of the Architect or Engineer whose decision on all points of difference shall be final and binding on this Contractor.
- C. The Contractor shall secure and pay for all necessary approvals, permits, inspections, certificates etc. required by state or local codes or statutes, rules, or regulations and pay all fees required unless specifically noted otherwise.
- D. All work and materials are required to be in compliance with State and Local Codes. Any conflicts between the plans and State or Local Codes, Rules, Statutes, or Regulations shall be brought to the Architect's or Engineer's attention in writing immediately.
- E. Schedule all required inspections with authorities having jurisdiction over the project and make corrections noted during such inspections.
- F. Plans are diagrammatic in nature and show the general design and arrangement of the systems. They are not intended to show each and every offset or fitting required for installation of work under this contract. This Contractor, as a licensed professional, is required to be proficient and knowledgeable in his trade and is required to include all such items and contingencies in his bid. The plans are not to be scaled for rough-in dimensions nor are they to be used for shop drawings.
  - 1. Where dimensions are given on the plans, they must be verified with actual field measurements taken on the project site. This Contractor shall take such field measurements as required to coordinate the installation of his work or to prepare shop drawings.
  - 2. Slight relocation of fixtures, equipment, devices and other items may be made by this Contractor as required to fit his work to casework, trim, brick coursing, etc as long as such relocation does not interfere with work of any other Contractor.
- G. Cutting, patching and firestopping for all work under this contract will be the responsibility of the installing contractor. Holes shall be cut in walls, floors, ceilings, etc as required for installation of materials, access for installation of materials or other reasons as may require cutting by this contractor for all of his work. Patching holes and spaces around installed materials or equipment shall also be by this contractor.
  - 1. All penetrations through walls, floors, ceilings, etc shall be sealed. Leave all patched surfaces in exposed locations ready for application of final finishes. Leave patched surfaces in concealed locations neat in appearance and continuous around all sides of the penetration.
  - 2. For non rated partitions, seal with caulk, grout or other approved material that is appropriate for the substrate that the patch is matched to. For 1 hour rated partitions, seal with approved non combustible materials as listed in the State Building Code. For penetrations in partitions with fire resistance ratings in excess of 1 hour, firestop penetrations with UL listed firestopping assemblies approved for the penetrating materials as well as the partition type and materials.

# 1.06 COORDINATION OTHER DIVISIONS

A. Requirements noted in this division are intended to be supplementary to Division 1 requirements. Where Division 1 requirements exceed the requirements in this section, the Division 1 requirements shall govern. Where requirements in this section exceed Division 1 requirements, the requirements in this division shall govern. This Contractor is required to review the Division 1 requirements as well as other Divisions to allow coordination of his work with other trades.

# 1.07 PERFORMANCE REQUIREMENTS

- A. All equipment installed in fire rated walls, ceilings, or other partitions shall be listed to maintain the fire rating and shall be installed to maintain the rating.
- B. Materials (such as conduit, pipes, ducts, etc.) passing through fire rated walls, ceilings or other partitions shall be suitably firestopped using only approved materials and methods to maintain the fire rating of the assembly.
- C. Schedule all required inspections by State and Local Authorities, and make all corrections as required by such inspections.

#### 1.08 SUBMITTALS

- A. Shop Drawings: Submit shop drawings as specified in the respective specification section. When equipment, materials or systems other than the one specified are submitted, this Contractor shall be required to clearly mark differences between the items submitted and the items specified. This Contractor shall be responsible for all changes required (including but not limited to piping, wiring, mounting, clearances, etc) under this and other divisions due to the use of items other than those specified.
  - 1. Shop drawings shall be submitted electronically in pdf format. Processed shop drawings will be returned electronically in pdf format.
  - 2. Submit shop drawings in one complete package and not at intervals.
  - 3. The Contractor shall check each submittal for accuracy and completeness prior to submitting the shop drawings to the Engineer. The Contractor shall stamp and sign the documents accordingly.
  - 4. Select and identify one product for each item that submitted. Multiple products will not be considered for an item.
  - 5. Each item being submitted for review shall be clearly identified in the submittal. In the event that multiple items are cataloged in a section and a single item is not clearly identified as the one that is being submitted, the Engineer may at his discretion select any suitable item from the page that meets or exceeds the requirements for the project.

#### **1.09 QUALITY ASSURANCE**

- A. Perform in accordance with state and local building codes, laws and ordinances .
- B. Obtain and pay for all inspections, permits, and fees required for work under this contract.
- C. Substitutions: Substitutions shall be made in accordance with the procedures given in the applicable Division 1 sections. The following procedures shall supplement the procedures given in Division 1. In the event that there are not substitution procedures given in Division 1, these procedures shall be used for all Division 23 and Division 26 items.
  - 1. When equipment, materials or systems other than the one specified are submitted, this Contractor shall be required to clearly mark differences between the items submitted and the items specified. This Contractor shall be responsible for all changes required (including but not limited to piping, wiring, mounting, clearances, etc) under this and other divisions due to the use of items other than those specified. The costs for these required changes shall be borne by the Contractor making the substitution at no additional costs to the Owner. The Engineer's decision on the acceptability of substitute equipment shall be final and binding under this contract. The acceptance of substitute items shall in no way relieve the Contractor from meeting any of the project requirements.
  - 2. Items that are to be substituted for a specified item shall be equal in quality, performance, capacity, size, construction, utility requirements, appearance, etc to the item specified.
  - 3. Substitutions may be made for all items specified using the term "or equal". Where an item is specified without the use of the term "or equal" that item must be used for the project bid. No substitutions may be made for items that are specified without the "or equal" term.
  - 4. Items exceeding the performance, efficiency, quality, etc may be used when approved by the Engineer, but no additional money will be paid under the contract for such features.
  - 5. The Engineer may consider qualities and characteristics of the specified item which may or may not have been specifically called out in the schedules or specifications when evaluating the suitability of a substitute item. The Engineer's decision regarding the acceptability of substitute items shall be final and binding under this contract.

- D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience and properly licensed to perform the work.
- E. Install equipment to comply with the Americans With Disabilities Act requirements.

# 1.10 DELIVERY, STORAGE, AND PROTECTION

- A. Store materials and equipment under cover and elevated above grade until ready for installation.
- B. Deliver materials and products to project site in their original shipping containers.

# 1.11 PROJECT CONDITIONS

- A. Coordinate new work installation with size, location and installation of any existing service utilities. Field verify all locations of utilities prior to beginning work and as necessary during project progress.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

#### 1.12 WARRANTY

- A. All labor, materials, and products supplied on this project shall have a minimum of 1 year parts and labor replacement warranty.
- B. Consult individual specification sections for additional warranty requirements. Warranty requirements stated in the subsequent specifications sections are supplemental to requirements in this warranty section.
- C. Correct defective Work within a one year period after Date of Substantial Completion unless a different date is given in Division 1 specifications sections. Provide all materials, labor, supplies etc. as required to remove, disassemble, replace, reassemble, etc. the failed or otherwise defective parts that are covered under the warranty terms.
- D. Provide five year manufacturer warranty for parts of all compressors.

# 1.13 MAINTENANCE SERVICE

A. Provide service and maintenance of all equipment installed under this contract for 12 months from Date of Substantial Completion.

# PART 2 PRODUCTS

#### 2.01 GENERAL

- A. All materials and equipment supplied on this project shall comply with the applicable standards for the material or equipment where such standard exists. All items shall be listed by Underwriters Laboratories or other approved third party listing agency where a listing is available.
- B. All materials and equipment used on the project shall be new unless specifically specified otherwise in the Project Plans or Specifications.
- C. All equipment used on the project shall be the latest current production model available at the time of bidding. No discontinued, superceded, suspended production models or otherwise obsolete equipment shall be used on this project. In the event that equipment is discontinued, superceded, or production is suspended on the models bid, current production models shall be substituted and so noted on the shop drawing submittals.
- D. All materials and equipment shall be in accordance with the North Carolina State Building Code (all volumes), local codes and ordinances and shall be approved for the intended use on the project.
- E. Materials and equipment of a similar type shall be supplied by the same manufacturer where possible. Do not provide similar products from two or more manufacturers unless a highly specialized item without equal has been specified. Do not provide similar products from two or more manufacturers if the items must fit together to provide their intended function.
- F. Manufacturers specified are to establish the quality and appearance level desired for the project. Equivalent items by other manufacturers are acceptable as substitutions provided the items are judged equal in the applicable characteristics by the Engineer.

# PART 3 EXECUTION

#### 3.01 EXAMINATION

A. Verify that conditions are proper for the installation of material or equipment prior to installing such equipment. Correct (or have corrected) any unsatisfactory conditions prior to installing materials or equipment.

#### 3.02 INSTALLATION

- A. Install materials and equipment in accordance with manufacturer's instructions and recommendations. Supply additional materials and labor as may be recommended by the manufacturer or where required for compliance with codes for the best installation of the materials or equipment whether such items are specifically called for otherwise in the project plans or specifications.
- B. Unless specifically shown otherwise on the plans, install all piping, ductwork, etc concealed from view of finished spaces.
- C. Coordinate rough-in of plumbing fixtures, thermostats, etc with the requirements of the Americans With Disabilities Act requirements.
- D. Install all equipment, materials, components, etc. in accordance with the applicable Building Code requirements and Building Related Laws. The project plans and specifications are prepared with the knowledge that bidders must be licensed contractors in their respective trade, and as such, are required to be knowledgeable of code and law requirements. All materials, components, accessories or other appurtenances required by code or law for a proper, safe, efficient, and legal installation shall be included in the project base bid price. Any and all work, materials, equipment, supplies or other items made necessary by code or law requirements shall be included in the project base bid price or not said items are specifically called for on the project plans or in the specifications. No additional charges shall be allowed to the contract for items that are legally required by such code or laws.
- E. Provide all cutting and patching as required for installation of materials or equipment under this contract, except where specifically noted otherwise on the plans.
- F. Where applicable, provide all demolition, disassembly, removal, transportation, and legal disposal of existing items that are not being reused or salvaged.
- G. Label all equipment, ductwork, and piping installed as well as all existing equipment and piping that remain on this project. Label equipment with engraved laminated phenolic plates secured to the exterior of the equipment. Label valves with brass valve tags and provide a Valve Tag Schedule. Label above ground pipes with the medium in the pipe and the flow direction. Label ducts with stenciled paint indicating the system number and function (supply, exhaust, return, relief, etc.)
- H. Identify underground piping by installing a plastic tape with indicator wire approximately 6" above the pipe.
- I. Provide all trenching and backfilling required for installation of work in this project. Backfill in 8" lifts and compact to 95% proctor unless a different compaction level is listed on the plan or in the earthwork sections of the specifications. Seed and straw disturbed grass areas. Patch disturbed paved areas equal to the adjacent paving. Provide new mulch for disturbed mulched areas.

#### 3.03 INTERFACE WITH OTHER WORK

- A. This Contractor shall coordinate his work with that of all other Contractors on the project and shall consult the drawings and specifications of the other trades to determine the nature and effect of work by others. This Contractor shall be responsible for all his work fitting in place with in an approved manner, and shall consult with others as required for drawings, dimensions, elevations, actual building measurements, etc. as necessary to insure that his work does fit properly and does not conflict with other trades.
- B. In the event that interferences develop, this Contractor shall cooperate with others to eliminate the interference. Should pipes, ductwork, conduit, equipment or other items have to be relocated, the Architect's or Engineer's decision will be the final authority as to which Contractor shall relocate his work.
- C. Coordinate voltage and current characteristics of all equipment installed with other Contractors, Subcontractors or Owner on the project.

- D. Coordinate the power connections for all equipment installed by this Contractor with other Contractors on the project.
- E. Consult the kitchen equipment shop drawings to determine exact rough-in and connection locations for kitchen equipment.
- F. Do not route pipes conveying water, sewer, gas or other medium over electrical panelboards.
- G. Do not route ducts over electrical panelboards.

# 3.04 FIELD QUALITY CONTROL

- A. Thoroughly inspect equipment installed on this project for proper installation prior to start-up of the equipment.
- B. Adjust and test each piece of equipment to insure that all operating and safety controls are functioning safely, properly and efficiently. Replace any defective items that would prevent such operations.

# 3.05 STARTING EQUIPMENT AND SYSTEMS

- A. Provide manufacturer's field representative to prepare and start major equipment such as boilers, chillers, condensing units larger than 25 tons, water heaters in excess of 60,000 btuh, variable frequency drives, energy recovery equipment, and air handling units larger than 10,000 cfm.
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of systems to Owner's designated representative and instruct him in the proper maintenance procedures of each system..

# 3.06 ADJUSTING

A. Adjust equipment for smooth, quiet, safe and efficient operation.

# 3.07 CLEANING

- A. Clean all equipment, piping, ductwork, labels, mechanical rooms, attics etc prior to project closeout. All construction debris is to be removed and properly disposed of. Remove all stains and drips from the equipment and from the building.
- B. Protect installed material and equipment from subsequent construction operations.
- C. Do not permit traffic over unprotected floor surface.

# SECTION 23-05-48

## VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

# PART 1 GENERAL

## **1.01 SECTION INCLUDES**

- A. Equipment support bases.
- B. Vibration isolators.

#### 1.02 SUBMITTALS

- A. Product Data:
  - 1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.
  - 2. Include seismic rating documentation for each isolator and restraint component accounting for horizontal, vertical, and combined loads.
- B. Shop Drawings:
  - 1. Provide schedule of vibration isolator type with location and load on each.
  - 2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.
  - 3. Include the calculations that indicate compliance with the applicable building code for seismic controls and the vibration isolator manufacturer's requirements.
  - 4. Include the seal of the Licensed Engineer registered in the State of North Carolina , on the drawings and calculations which at a minimum include the following:
    - a. Seismic Restraint Details: Detailed drawings of seismic restraints and snubbers including anchorage details that indicate quantity, diameter, and depth of penetration, edge distance, and spacing of anchors.
    - b. Detailed description of the equipment anchorage devices on which the certifications are based.
- C. Product Data: Provide schedule of vibration isolator type with location and load on each.
- D. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate seismic control measures.
- E. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

# 1.03 QUALITY ASSURANCE

- A. Perform design and installation in accordance with applicable codes.
- B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and registered and licensed in the State of North Carolina.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
  - 1. Member of Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Kinetics Noise Control, Inc: www.kineticsnoise.com.
- B. Mason Industries: www.mason-ind.com.
- C. Vibration Eliminator Company, Inc: www.veco-nyc.com.

#### 2.02 PERFORMANCE REQUIREMENTS

- A. General:
  - 1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
  - 2. Steel springs to function without undue stress or overloading.

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

## 2.03 EQUIPMENT SUPPORT BASES

#### 2.04 VIBRATION ISOLATORS

- A. Non-Seismic Type:
  - 1. All Elastomeric-Fiber Glass Pads:
    - a. Configuration: Flat or molded.
    - b. Thickness: 0.25 inch minimum.
    - c. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with load plate providing evenly distributed load over pad surface.
  - 2. Elastomeric Mounts:
    - a. Material: Oil, ozone, and oxidant resistant compounds.
    - b. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
  - 3. Steel Springs:
    - a. Assembly: Freestanding, laterally stable without housing.
    - b. Leveling Device: Rigidly connected to equipment or frame.
  - 4. Elastomeric Hangers:
    - a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
    - b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.
  - 5. Spring Hanger:
    - a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
    - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
  - 6. Combination Elastomeric-Spring Hanger:
    - a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
    - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

# PART 3 EXECUTION

#### 3.01 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- C. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

# 3.02 FIELD QUALITY CONTROL

- A. See Section 01-40-00 Quality Requirements, for additional requirements.
- B. Inspect isolated equipment after installation and submit report. Include static deflections.

# SECTION 23-05-53

# IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

# PART 1 GENERAL

# **1.01 SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe Markers.

# 1.02 REFERENCE STANDARDS

- A. ASME A13.1 Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers.
- B. ASTM D709 Standard Specification for Laminated Thermosetting Materials.

# 1.03 SUBMITTALS

- A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- E. Project Record Documents: Record actual locations of tagged valves.

# PART 2 PRODUCTS

# 2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Automatic Controls: Tags. Key to control schematic.
- C. Control Panels: Nameplates.
- D. Dampers: Ceiling tacks, where located above lay-in ceiling.
- E. Ductwork: Stencilled painting.
- F. Instrumentation: Tags.
- G. Major Control Components: Nameplates.
- H. Piping: Labels.
- I. Relays: Tags.
- J. Small-sized Equipment: Tags.
- K. Thermostats: Labels.
- L. Valves: Tags and ceiling tacks where located above lay-in ceiling.

# 2.02 NAMEPLATES

- A. Manufacturers:
  - 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
  - 2. Brimar Industries, Inc.: www.pipemarker.com.
  - 3. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
  - 4. Seton Identification Products: www.seton.com.
  - 5. Letter Color: White.
  - 6. Letter Height: 1/4 inch.
  - 7. Background Color: Black.
  - 8. Plastic: Conform to ASTM D709.

# 2.03 TAGS

A. Manufacturers:

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

- 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
- 2. Brady Corporation: www.bradycorp.com.
- 3. Brimar Industries, Inc.: www.pipemarker.com.
- 4. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
- 5. Seton Identification Products: www.seton.com.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

# 2.04 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
  - 1. Ductwork and Equipment: 2-1/2 inch high letters.

# 2.05 PIPE MARKERS

- A. Manufacturers:
  - 1. Brady Corporation: www.bradycorp.com.
  - 2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
  - 3. MIFAB, Inc.: www.mifab.com.
  - 4. Seton Identification Products: www.seton.com.
  - B. Color: Conform to ASME A13.1.
  - C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
  - D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

# 2.06 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
  - 1. HVAC Equipment: Yellow.
  - 2. Fire Dampers and Smoke Dampers: Red.
  - 3. Heating/Cooling Valves: Blue.

# PART 3 EXECUTION

# 3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09-91-23 for stencil painting.

# 3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners. Do not use adhesives to affix nameplates.
- B. Install tags with corrosion resistant chain.
- C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
  - 1. Identify service and flow direction.
  - 2. Install in clear view and align with centerline axis of piping.
  - 3. Spacing not to exceed 20' between markers, 5' from wall, floor, or roof penetrations, and 5' from equipment, valves, or tees.
- D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- E. Identify ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

F. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

# SECTION 23-05-93

# TESTING, ADJUSTING, AND BALANCING FOR HVAC

# PART 1 GENERAL

# **1.01 SECTION INCLUDES**

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.

## 1.02 REFERENCE STANDARDS

- A. AABC MN-1 AABC National Standards for Total System Balance; Associated Air Balance Council.
- B. ASHRAE Std 111 Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..
- C. NEBB (TAB) Procedural Standard for Testing Adjusting and Balancing of Environmental Systems; National Environmental Balancing Bureau.

#### 1.03 SUBMITTALS

- A. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
  - 1. Submit to Engineer.
  - 2. Include at least the following in the plan:
    - a. Preface: An explanation of the intended use of the control system.
    - b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    - c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    - d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    - e. Final test report forms to be used.
    - f. Procedures for formal deficiency reports, including scope, frequency and distribution.
- C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
  - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.
  - 3. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
  - 4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
  - 5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
  - 6. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
  - 7. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.
  - 8. Include the following on the title page of each report:
    - a. Project name.
    - b. Project location.
    - c. Project Engineer.
    - d. Project Engineer.
    - e. Project Contractor.
    - f. Project altitude.
    - g. Report date.

# 1.04 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC MN-1, ASHRAE Std 111, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

# PART 2 PRODUCTS - NOT USED

# PART 3 EXECUTION

# 3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
  - Company specializing in the testing, adjusting, and balancing of systems specified in this section.

# 1. Compa 3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.
  - 3. Proper thermal overload protection is in place for electrical equipment.
  - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  - 5. Duct systems are clean of debris.
  - 6. Fans are rotating correctly.
  - 7. Fire and volume dampers are in place and open.
  - 8. Air coil fins are cleaned and combed.
  - 9. Access doors are closed and duct end caps are in place.
  - 10. Air outlets are installed and connected.
  - 11. Duct system leakage is minimized.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

# 3.03 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

# 3.04 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

#### 3.05 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

# 3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

# TESTING, ADJUSTING, AND BALANCING FOR HVAC

- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to the extent that such adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

# 3.07 SCOPE

- A. Test, adjust, and balance the following:
  - 1. Air Coils
  - 2. Air Handling Units
  - 3. Fans
  - 4. Air Inlets and Outlets

# SECTION 23-07-13 DUCT INSULATION

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct Liner.
- C. Insulation jackets.

# 1.02 RELATED REQUIREMENTS

- A. Section 22-05-53 Identification for Plumbing Piping and Equipment.
- B. Section 23-05-53 Identification for HVAC Piping and Equipment.
- C. Section 23-31-00 HVAC Ducts and Casings: Glass fiber ducts.

#### 1.03 REFERENCE STANDARDS

- A. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- B. ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- C. ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- D. ASTM C916 Standard Specification for Adhesives for Duct Thermal Insulation.
- E. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. SMACNA (DCS) HVAC Duct Construction Standards Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.
- G. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc..

#### 1.04 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

#### 1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

## PART 2 PRODUCTS

#### 2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

#### 2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
  - 1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
  - 2. Maximum service temperature: 250 degrees F.
  - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
  - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  - 2. Moisture vapor transmission: ASTM E 96; 0.02 perm.
  - 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
  - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Outdoor Vapor Barrier Mastic:
- F. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

# 2.03 GLASS FIBER, RIGID

- A. Insulation: ASTM C612; rigid, noncombustible blanket.
  - 1. 'K' Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
  - 2. Maximum Service Temperature: 450 degrees F.
  - 3. Maximum Water Vapor Absorption: 5.0 percent.
  - 4. Density: 3.0 lb/cu ft.
- B. Vapor Barrier Jacket:
  - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  - 2. Moisture vapor transmission: ASTM E 96; 0.04 perm.
  - 3. Secure with pressure sensitive tape.
- C. Vapor Barrier Tape:
  - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- D. Indoor Vapor Barrier Finish:
  - 1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
  - 2. Vinyl emulsion type acrylic, compatible with insulation, white color.

# 2.04 JACKETS

A. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square.

#### 2.05 DUCT LINER

- A. Manufacturers:
  - 1. Knauf Insulation; \_\_\_\_\_: www.knaufinsulation.com.
  - 2. Johns Manville: www.jm.com.
  - 3. CertainTeed Corporation; : www.certainteed.com.
- B. Insulation: ASTM C 1071; flexible, noncombustible blanket with impregnated surface and edge coat.
  - 1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
  - 2. Service Temperature: Up to 250 degrees F.
  - 3. Maximum Velocity on Coated Air Side: 5,000 fpm.
  - 4. Greenguard Children and Schools Certified.
  - 5. Minimum Noise Reduction Coefficients:
    - a. 1 inch Thickness: 0.45.

- C. Adhesive: Waterproof, fire-retardant type, ASTM C916.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify that ducts have been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

# 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated ducts conveying air below ambient temperature:
  - 1. Provide insulation with vapor barrier jackets.
  - 2. Finish with tape and vapor barrier jacket.
  - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Insulated ducts conveying only air above ambient temperature:
  - 1. Provide with or without standard vapor barrier jacket.
  - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.
- F. External Duct Insulation Application:
  - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
  - 2. Secure insulation without vapor barrier with staples, tape, or wires.
  - 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
  - 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
  - 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- G. Duct and Plenum Liner Application:
  - 1. Adhere insulation with adhesive for 90 percent coverage.
  - 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
  - 3. Seal and smooth joints. Seal and coat transverse joints.
  - 4. Seal liner surface penetrations with adhesive.
  - 5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

# 3.03 SCHEDULES

- A. Unless another material or greater thickness is shown on the plans, insulation types and thickness for various ductwork types shall be as scheduled below:
- B. Supply Duct Sections Within 10' of Air Handling Unit, Terminal Unit, Furnace, etc (not exposed to ambient air temperatures):
  - 1. Flexible Glass Fiber Duct Liner Insulation: [1] inches thick;
  - 2. and Flexible Glass Fiber Duct Insulation: [2] inches thick:
- C. Supply Duct Sections Farther Than 10' from Air Handling Unit, Terminal Unit, Furnace, etc (not exposed to ambient air temperatures):
  - 1. Flexible Glass Fiber Duct Insulation: [2] inches thick:
- D. Return and Relief Ducts (Not Exposed to Ambient Temperatures):
- Flexible Glass Fiber Duct Liner Insulation: [1] inches thick
   Transfer Ducts (Not Exposed to Ambient Temperatures):

1. Flexible Glass Fiber Duct Liner Insulation: [1] inches thick

# SECTION 23-07-19 HVAC PIPING INSULATION

## PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Piping insulation.
- B. Jackets and accessories.

# 1.02 RELATED REQUIREMENTS

- A. Section 07-84-00 Firestopping.
- B. Section 22-10-05 Plumbing Piping: Placement of hangers and hanger inserts.
- C. Section 23-21-13 Hydronic Piping: Placement of hangers and hanger inserts.

#### 1.03 REFERENCE STANDARDS

- A. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].
- C. ASTM C177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
- D. ASTM C195 Standard Specification for Mineral Fiber Thermal Insulating Cement.
- E. ASTM C449 Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
- F. ASTM C534/C534M Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- G. ASTM C547 Standard Specification for Mineral Fiber Pipe Insulation.
- H. ASTM C552 Standard Specification for Cellular Glass Thermal Insulation.
- I. ASTM C795 Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- J. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- K. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials.
- L. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc..

# 1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of experience.

# 1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

# 1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

# PART 2 PRODUCTS

# 2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.
### 2.02 GLASS FIBER

- A. Manufacturers:
  - 1. CertainTeed Corporation: www.certainteed.com.
  - 2. Johns Manville Corporation: www.jm.com.
  - 3. Knauf Insulation: www.knaufinsulation.com.
  - 4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com.
- B. Insulation: ASTM C547; rigid molded, noncombustible.
  - 1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
  - 2. Maximum Service Temperature: 850 degrees F.
  - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
  - 1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
  - 2. Maximum Service Temperature: 650 degrees F.
  - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- F. Vapor Barrier Lap Adhesive: Compatible with insulation.
- G. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- H. Fibrous Glass Fabric:
  - 1. Cloth: Untreated; 9 oz/sq yd weight.
  - 2. Blanket: 1.0 lb/cu ft density.
  - 3. Weave: 5x5.
- I. Indoor Vapor Barrier Finish:
  - 1. Cloth: Untreated; 9 oz/sq yd weight.
  - 2. Vinyl emulsion type acrylic, compatible with insulation, black color.
- J. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- K. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- L. Insulating Cement: ASTM C449.

# 2.03 CELLULAR GLASS

- A. Insulation: ASTM C552, Type II.
  - 1. Apparent Thermal Conductivity; 'K' Value: Grade 6, 0.35 at 100 degrees F.
  - 2. Service Temperature: Up to 800 degrees F.
  - 3. Water Vapor Permeability: 5 perm inch 5 perm inch .
  - 4. Water Absorption: 0.5 percent by volume, maximum.

### 2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
  - 1. Aeroflex USA, Inc: www.aeroflexusa.com.
  - 2. Armacell LLC: www.armacell.us.
  - 3. K-Flex USA LLC: www.kflexusa.com.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
  - 1. Minimum Service Temperature: Minus 40 degrees F.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

#### 2.05 JACKETS

- A. PVC Plastic.
  - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum Service Temperature: 0 degrees F.

- b. Maximum Service Temperature: 150 degrees F.
- c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
- d. Thickness: 10 mil.
- e. Connections: Brush on welding adhesive.
- 2. Covering Adhesive Mastic: Compatible with insulation.
- B. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
  - 1. Lagging Adhesive: Compatible with insulation.
- C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
  - 1. Thickness: 0.016 inch sheet.
  - 2. Finish: Smooth.
  - 3. Joining: Longitudinal slip joints and 2 inch laps.
  - 4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
  - 5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

# 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
  - 1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- H. Glass fiber insulated pipes conveying fluids above ambient temperature.
  - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
  - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- I. Inserts and Shields:
  - 1. Application: Piping 1-1/2 inches diameter or larger.
  - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  - 3. Insert location: Between support shield and piping and under the finish jacket.
  - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  - 5. Insert material: Cellular glass insulation or other heavy density insulating material suitable for the planned temperature range.
- J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07-84-00.

- K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.
- L. Exposed pipe drops to equipment: Finish with stainless steel jacket.
- M. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.
- N. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.
- O. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- P. Do not insulate refrigerant suction and discharge piping in a common insulation jacket.
- Q. Paint flexible elastomeric insulation with sunlight resistant paint as recommended by the insulation manufacturer.

# 3.03 SCHEDULE

- A. Hydronic Loop Water Piping Fiberglass piping insulation system.
  - 1. Loop that operate at temperatures between 50F-90F
    - a. No insulation required.
  - 2. Loops that operate at any time below 50F or above 90F:
    - a. 1/2"-1-1/2": 1-1/2" wall thickness.
    - b. 2" and larger: 2" wall thickness.
- B. Hydronic Heating Systems Fiberglass piping insulation system:
  - 1. Heating Water Supply and Return Piping:
    - a. 1/2"-1-1/2": 1-1/2" wall thickness.
    - b. 2" and larger: 2" wall thickness.
- C. Hydronic Cooling Systems Fiberglass piping insulation system:
- D. Refrigerant Heating and/or Cooling Systems Flexible elastomeric insulation:
  - 1. Refrigerant Suction Flexible elastomeric insualtion:
    - a. 3/8"-1" Tubing:1/2" wall thickness.
    - b. 1-1/8"-2" Tubing1" wall thickness.
  - 2. Refrigerant Hot Gas:
    - a. 3/8"-1" Tubing:1/2" wall thickness
    - b. 1-1/8"-2" Tubing1" wall thickness.

# SECTION 23-21-13 HYDRONIC PIPING

#### PART 1 GENERAL

### **1.01 SECTION INCLUDES**

- A. Hydronic system requirements.
- B. Heating water and glycol piping, above grade.
- C. Pipe and pipe fittings for:
  - 1. Heating water piping system.
- D. Pipe hangers and supports.
- E. Unions, flanges, mechanical couplings, and dielectric connections.
- F. Valves:
  - 1. Globe or angle valves.
  - 2. Ball valves.
  - 3. Plug valves.
  - 4. Butterfly valves.
  - 5. Check valves.

### 1.02 RELATED REQUIREMENTS

- A. Section 09-91-23 Interior Painting.
- B. Section 22-07-19 Plumbing Piping Insulation.

### 1.03 REFERENCE STANDARDS

- A. ASME BPVC-IX Boiler and Pressure Vessel Code, Section IX Welding, Brazing, and Fusing Qualifications; The American Society of Mechanical Engineers.
- B. ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- C. ASME B31.9 Building Services Piping (ANSI/ASME B31.9).
- D. ASTM A234/A234M Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- E. ASTM B32 Standard Specification for Solder Metal.
- F. ASTM B88 Standard Specification for Seamless Copper Water Tube.
- G. ASTM B88M Standard Specification for Seamless Copper Water Tube (Metric).
- H. ASTM F708 Standard Practice for Design and Installation of Rigid Pipe Hangers.
- I. AWS A5.8/A5.8M Specification for Filler Metals for Brazing and Braze Welding; American Welding Society.
- J. AWS A5.8/A5.8M Specification for Filler Metals for Brazing and Braze Welding; American Welding Society.
- K. AWS D1.1/D1.1M Structural Welding Code Steel; American Welding Society.
- L. AWWA C606 Standard Specification for Grooved and Shouldered Joints; American Water Works Association.
- M. MSS SP-58 Pipe Hangers and Supports Materials, Design and Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..

#### 1.04 ADMINISTRATIVE REQUIREMENTS

#### 1.05 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

- C. Use non-conducting dielectric connections whenever jointing dissimilar metals in piping systems.
- D. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.
- E. Use ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- F. Use globe or ball valves for throttling, bypass, or manual flow control services.
- G. Use only butterfly valves in chilled and condenser water systems for throttling and isolation service.
- H. Use lug end butterfly valves to isolate equipment.
- I. Use 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

#### 1.06 SUBMITTALS

- A. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
- B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.
- C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- D. Project Record Documents: Record actual locations of valves.
- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

### 1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum 3 years of experience.
- C. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

### 1.08 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of piping system.
- B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

# PART 2 PRODUCTS

# 2.01 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
  - 1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
  - 2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
  - 3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
  - 4. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.
- C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
- D. Valves: Provide valves where indicated:

- 1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch ball valves with cap; pipe to nearest floor drain.
- 2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
- 3. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.
- 4. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.
- E. Welding Materials and Procedures: Conform to ASME BPVC-IX.

# 2.02 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
  - 1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:
  - 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
    - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
    - b. Braze: AWS A5.8/A5.8M BCuP copper/silver alloy.
  - 2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
  - 3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

# 2.03 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:

# 2.04 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
  - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
- B. Conform to ASME B31.9.
- C. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
- D. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
- E. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
- F. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
- G. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- H. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
- I. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- J. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
- K. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
- L. Vertical Support: Steel riser clamp.
- M. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- N. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- O. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- P. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- Q. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- R. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

S. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

# 2.05 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

- A. Unions for Pipe 2 Inches and Under:
  - 1. Ferrous Piping: 150 psig malleable iron, threaded.
    - 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe Over 2 Inches:
  - 1. Ferrous Piping: 150 psig forged steel, slip-on.
  - 2. Copper Piping: Bronze.
  - 3. Gaskets: 1/16 inch thick preformed neoprene.
- C. Dielectric Connections: Union or waterway fitting with water impervious isolation barrier and one galvanized or plated steel end and one copper tube end, end types to match pipe joint types used.

# 2.06 GLOBE OR ANGLE VALVES

- A. Up To and Including 2 Inches:
  - 1. Bronze body, bronze trim, screwed bonnet, rising stem and handwheel, inside screw with backseating stem, renewable composition disc and bronze seat, solder ends.
- B. Over 2 Inches:
  - 1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

# 2.07 BALL VALVES

- A. Up To and Including 2 Inches:
  - 1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

# 2.08 PLUG VALVES

- A. Up To and Including 2 Inches:
  - 1. Bronze body, bronze tapered plug, 40 percent port opening, non-lubricated, teflon packing, threaded ends.
  - 2. Operator: One plug valve wrench for every ten plug valves minimum of one.

# 2.09 BUTTERFLY VALVES

- A. Manufacturers:
  - 1. Crane Co.: www.cranevalve.com.
  - 2. Grinnell Products, a Tyco Business: www.grinnell.com.
  - 3. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.
  - 4. Hammond Valve: www.hammondvalve.com.
  - 5. Milwaukee Valve Company: www.milwaukeevalve.com.
  - 6. Victaulic Company: www.victaulic.com.
- B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, grooved, or threaded ends, extended neck.
- C. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM enscapsulation, or Buna-N enscapsulation.
- D. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.
- E. Disc: Aluminum bronze.
- F. Operator: 10 position lever handle.

# 2.10 SWING CHECK VALVES

- A. Up To and Including 2 Inches:
  - 1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

# PART 3 EXECUTION

### 3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment using jointing system specified.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- E. After completion, fill, clean, and treat systems. Refer to Section 23-25-00 for additional requirements.

### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install heating water, glycol, chilled water, condenser water, and engine exhaust piping to ASME B31.9 requirements.
- C. Install heating water, piping to ASME B31.9 requirements.
- D. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- E. Install piping to conserve building space and to avoid interfere with use of space.
- F. Group piping whenever practical at common elevations.
- G. Sleeve pipe passing through partitions, walls and floors.
- H. Slope piping and arrange to drain at low points.
- I. Inserts:
  - 1. Provide inserts for placement in concrete formwork.
  - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
  - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
  - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.
- J. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
  - 2. Support horizontal piping as scheduled.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 8. Provide copper plated hangers and supports for copper piping.
  - 9. Prime coat exposed steel hangers and supports. Refer to Section 09-91-23. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22-07-19.
- L. Provide access where valves and fittings are not exposed.
- M. Use eccentric reducers to maintain top of pipe level.
- N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- O. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
- P. Install valves with stems upright or horizontal, not inverted.

### 3.03 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
  - 1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 5. 3 inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 6. 4 inch: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- B. Hanger Spacing for Steel Piping.
  - 1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  - 2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
  - 6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  - 7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
  - 8. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
  - 9. 8 inches: Maximum span, 19 feet; minimum rod size, 5/8 inch.
  - 10. 10 inches: Maximum span, 20 feet; minimum rod size, 3/4 inch.

# SECTION 23-21-13.33

# GROUND-LOOP HEAT-PUMP PIPING

# PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Ground-coupled heat exchanger and connections to building piping system, serving:
1. Hydronic piping system specified in Section 23-21-13.

#### 1.02 RELATED REQUIREMENTS

A. Section 23-21-13 - Hydronic Piping: Building heating piping system.

### 1.03 REFERENCE STANDARDS

- A. APHA (EWWW) Standard Methods for the Examination of Water and Wastewater; American Public Health Association.
- B. ASHRAE (HVACA) ASHRAE Handbook HVAC Applications.
- C. ASTM D2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
- D. ASTM D2837 Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
- E. ASTM D3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
- F. ASTM D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- G. ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Material.
- H. ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
- I. ASTM F1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing.
- J. IGSHPA (GROUT) Grouting Procedures for GHP Systems; International Ground Source Heat Pump Association.
- K. IGSHPA (INSTALL) Closed-Loop/Geothermal Heat Pump Systems Design and Installation Standards; International Ground Source Heat Pump Association.
- L. PPI TR-4 PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDS), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe; Plastics Pipe Institute.

# 1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section. Require attendance by all installers involved with site work and HVAC work.

#### 1.05 SUBMITTALS

- A. Product Data, Polyethylene Piping: Provide manufacturer's data for piping and pipe fittings, showing compliance with specified requirements.
  - 1. Provide manufacturer's recommendations for fusion jointing.
  - 2. Include certification of long term hydrostatic basis, or test reports.
- B. Product Data, Heat Exchange Fluid: Provide data showing compliance with specified requirements.
  - 1. Provide manufacturer's Material Data Safety Sheets.
  - 2. Provide results of biodegradability studies conducted in accordance with APHA (EWWW):
    - a. Statement of ecological behavior.
    - b. Total oxygen demand, in pounds of oxygen per pound of fluid.
    - c. Percent of fluid degraded in five days.
- C. Product Data, Grout and Slurry: Provide information on thermal conductivity of proposed materials.

- D. Shop Drawings: Show complete piping layout, water table, water level, depths of excavation, final depths of piping, backfill placement, point of entrance to building, point of connection to equipment, test point locations, and fittings used for all joints and connections.
- E. Design Calculations: Submit all design calculations along with drawings.
- F. Samples: Provide one 2-inch length of pipe in selected size.
- G. Soil and Rock Samples: Provide one sample from the area of proposed installation
- H. Test Reports, Soil: Indicate test methods and results for all tests performed on soil samples to determine stability, conductivity, and thermal values.
- I. Test Reports, Piping: Indicate test method and results of hydrostatic pressure tests.
- J. Record Documents: Record actual locations of all underground piping installed relative to Owner's permanent structure on same property.
- K. Operation and Maintenance Data: Provide procedures for pressurizing, charging, and isolation for equipment replacement.

# 1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Experienced designer, regularly engaged in the design of systems of the type and capacity specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of documented experience and accredited by IGSHPA.
- C. Heat Fusion Technician Certification: IGSHPA training and certification, certified within three years from the date of project commencement.

# 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping and fittings to project site in shipping containers with labeling in place.
  - 1. Verify that labels on piping indicate manufacturer's name, pipe or tube size, and PE cell classification.
  - 2. Verify that piping complies with specifications and is undamaged.
- B. Deliver chemicals for heat exchange fluid to project site in unopened shipping containers with labeling in place; comply with local and state regulations.
- C. Protect from weather, humidity and temperature variations, dirt and dust, and other environmental contaminants.
- D. Store piping capped or plugged until time of installation.

# PART 2 PRODUCTS

# 2.01 HEAT EXCHANGER

- A. Contractor is responsible for design and execution of the closed-system ground-coupled heat exchanger, to the requirements of and within the limitations of the Contract Documents.
  - 1. Design in accordance with methodology in IGSHPA Closed-Loop/Geothermal Heat Pump Systems Design and Installation Standards or ASHRAE Handbook - HVAC Applications, Geothermal Energy Chapter.
  - 2. Design heat exchanger to comply with heat pump manufacturer's specifications and operating requirements.
  - 3. Circulator pumps, utilization equipment, gages, and sensors are specified elsewhere and are the responsibility of this designer.
  - 4. If the Drawings do not indicate the interface between the heat exchanger and the equipment, provide three valves and a by-pass to isolate the heat exchanger from the equipment plus at least one charging valve.
  - 5. Provide an IGSHPA registered system, with certificate and label.
- B. Heat Exchanger Configuration: Closed system; polyethylene piping in vertical boreholes located on the property near to the building, at a location determined in consulation with the building ower.
  - 1. Pipe Diameter: 3 inch.
  - 2. Borehole Dimensions and Spacing: As required to achieve specified performance.

- C. Heat Exchanger Performance:
  - 1. Heat Transfer Capacity for Heating: 200000 Btuh.
  - 2. Maximum Working Pressure: 120 psig.
  - 3. Design Operating Pressure: 20 psig.
  - 4. Minimum Winter Temperature of Fluid (Winter Inlet Temperature): 32 degrees F.
  - 5. Maximum Summer Temperature of Fluid (Summer Inlet Temperature): 77 degrees F.

# 2.02 MATERIALS

- A. Pipe: High density polyethylene pipe, type PE3408, PE3608, or PE4710, with minimum ASTM D3350 cell classification of PE345364C.
  - 1. Pipe Used in Vertical Bore Applications: Comply with ASTM D3035 with minimum working pressure rating of 160 psi.
  - 2. Other Pipe of 3 Inches Diameter and Larger: Comply with ASTM D3035 or ASTM F714, with minimum working pressure rating of 100 psi.
  - 3. Other Pipe 1.25 Inches But Less Than 3 Inches In Diameter (Nominal): Comply with ASTM D3035 with minimum working pressure rating of 110 psi.
  - 4. Other Pipe Less Than 1.25 Inches in Diameter (Nominal): Comply with ASTM D3035 with minimum working pressure rating of 160 psi.
  - 5. Long Term Hydrostatic Design Basis: 1600 psi at 73 degrees F, when tested in accordance with ASTM D2837; appropriate listing in current edition of PPI TR-4 will constitute evidence of compliance with this requirement; otherwise, submit independent test results.
  - 6. Joints and Fittings: Polyethylene of same type as pipe, of sizes and types suitable for the pipe being used; use only heat fusion or stab-type mechanical fittings that are quality controlled to provide a leak-free union between piping ends that is stronger than the piping itself. Do not use other barbed fittings or hose clamps.
    - a. Electrofusion Type Fittings: Comply with ASTM F1055.
    - b. Butt Fusion Fittings: Comply with ASTM D3261.
    - c. Socket Type Fittings: Comply with ASTM D2683.
    - d. Where threaded fittings must be used for connection to equipment or dissimilar piping, use fittings and thread sealant compatible and effective with antifreeze used.
- B. Heat Exchange Fluid: Water and antifreeze solution, 23.5 percent propylene glycol by weight.
- C. Pipe Insulation: Closed cell, water resistant plastic foam with thermal resistance of at least R2.
- D. Detectable Underground Tape: Magnetic detectable conductor in 2 inch wide rot-resistant plastic tape or mesh, brightly colored, imprinted with "Water Line" in large letters.
- E. Backfill for Vertical Boreholes: Bentonite.

# PART 3 EXECUTION

# 3.01 EXAMINATION AND PREPARATION

- A. Verify location of existing structures and utilities prior to excavation.
- B. Verify soil composition and rock depth, if any, before beginning excavation.
- C. Protect adjacent structures from the effects of excavation.
- D. Verify that layout dimensions are correct and that available land is sufficient for design.
- E. Notify Engineer of unsatisfactory conditions.
- F. Do not proceed with installation until unsatisfactory conditions have been corrected.
- G. Coordinate work with site grading, site backfilling, and foundation construction.

# 3.02 EXCAVATION

- A. Excavate in accordance with requirements of authorities having jurisdiction.
- B. Remove rock as specified for rock removal for the site.
- C. Vertical Boreholes: Drill to depths required.
  - 1. Minimize over-drilling; fill over-drilled areas with backfill or excavated materials.
  - 2. Piping: Assemble heat exchanger piping and test before installation.

- D. Trenches: Excavate trenches for piping to lines and grades shown on drawings.
  - 1. Minimize over-excavation; fill over-excavated areas with backfill or excavated materials.
  - 2. Excavate to accommodate grade changes.
  - 3. Maintain trenches free of debris, material, and obstructions that may damage pipe.
  - 4. Piping: Assemble heat exchanger piping and test before backfilling.

### 3.03 POLYETHYLENE PIPING

- A. Join piping and fittings using heat fusion or electrofusion; do not use solvents, adhesives, or mechanical fittings.
- B. Provide flanges or unions to connect heat exchanger piping to equipment or piping of different type; locate all transitions between piping of different types inside the building or otherwise accessible (i.e. above grade).
- C. Keep dirt, water, and debris out of pipe assemblies; cap or plug open ends until connected to adjacent piping.
- D. Do not bend piping to shorter radius than recommended by pipe manufacturer; do not kink piping; use elbow or other fittings for sharp bends.
- E. Partially backfill radius bends in narrow trenches by hand to ensure that piping is properly supported and to prevent kinking.
- F. Test piping to be installed in boreholes after assembly but before installation in boreholes; re-cap tested assemblies before installation.
- G. Test piping to be installed in trenches after installation but before backfilling.
- H. Testing: Perform hydrostatic test on all piping; portions of assembled piping may be tested separately.
  - 1. Prior to testing, isolate piping from all connections to building systems.
  - 2. Flush all dirt and debris using potable water flowing at twice the normal operating flow rate for a minimum of four hours or until no dirt or debris is visible, whichever is longer.
  - 3. Plug or cap piping.
  - 4. Pressurize piping to 150 psi for 30 minutes and monitor.
  - 5. If there is any pressure loss or visible leakage, identify leak and repair in accordance with manufacturer's recommendations.
  - 6. Repeat test until there is no loss of pressure for the duration of the test.
- I. Insulation: Insulate the following heat exchanger piping:
  - 1. Above ground piping.
  - 2. Indoor piping that will be colder than ambient air temperature.
- J. Where piping passes through foundation walls, provide sleeves sealed with non-hardening, waterproof material.
- K. After connection of piping to building systems and installation of equipment served by heat exchanger, fill piping with heat exchange fluid and pressurize.
  - 1. Water Temperature of 70 to 90 degrees F: Pressurize to 20 to 30 psi, minimum.
  - 2. Water Temperature of 40 to 50 degrees F: Pressurize to 40 to 50 psi, minimum.
  - 3. If adequate flooding of circulating pump can be accomplished without pressurization and pump manufacturer approves, pressurization is not required.
  - 4. After pressurization, remove charging valve handles, or plug ports, whichever is applicable, and deliver handles to Owner.
  - 5. Install system label at charging valves, indicating:
    - a. Heat exchange fluid, including antifreeze type and concentration.
    - b. Service date.
    - c. Company name.
    - d. Company phone number and responsible person.

# 3.04 BACKFILLING

- A. Install in compliance with local authorities having jurisdiction.
- B. Vertical Boreholes: Backfill after pipe installation in accordance with IGSHPA Grouting Procedures for GHP Systems.

- C. Trenches:
  - 1. Provide minimum 18 inch cover over piping.
  - 2. Backfill trenches after pipe has been installed and tested, using fill free of rocks and other debris.
  - 3. Install detectable tape continuously 6 inches above top of all buried pipe.
  - 4. Backfill in 8" lifts and compact to 95% in unpaved areas and 98% in paved areas.
  - 5. Backfill to original grades with sufficient overfill to allow for settlement.
- D. Protect piping from displacement.

# 3.05 CLEANING

- A. Leave adjacent paved areas broom clean.
- B. Clear debris, including excess backfill and excavated dirt and rock, from heat exchanger area.

# 3.06 PROTECTION

- A. Protect area during excavation from excess runoff and erosion.
- B. Protect pipe protrusions from damage until connections to building systems are installed.

# SECTION 23-23-00 REFRIGERANT PIPING

### PART 1 GENERAL

### **1.01 SECTION INCLUDES**

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.
- D. Valves.
- E. Strainers.
- F. Filter-driers.
- G. Solenoid valves.
- H. Expansion valves.

# 1.02 RELATED REQUIREMENTS

- A. Section 22-07-19 Plumbing Piping Insulation.
- B. Section 23-62-13 AIR COOLED CONDENSING UNITS.

# 1.03 REFERENCE STANDARDS

- A. AHRI 710 Performance Rating of Liquid-Line Driers; Air-Conditioning, Heating, and Refrigeration Institute.
- B. AHRI 760 Standard for Performance Rating of Solenoid Valves for Use With Volatile Refrigerants; Air-Conditioning, Heating, and Refrigeration Institute.
- C. ASHRAE Std 15 Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ANSI/ASHRAE Std 15).
- D. ASHRAE Std 34 Designation and Safety Classification of Refrigerants; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..
- E. ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; The American Society of Mechanical Engineers.
- F. ASME B16.26 Cast Copper Alloy Fittings For Flared Copper Tubes; The American Society of Mechanical Engineers.
- G. ASME B31.5 Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers.
- H. ASME B31.9 Building Services Piping; The American Society of Mechanical Engineers (ANSI/ASME B31.9).
- I. ASTM B88 Standard Specification for Seamless Copper Water Tube.
- J. ASTM B88M Standard Specification for Seamless Copper Water Tube (Metric).
- K. ASTM B280 Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- L. AWS A5.8M/A5.8 Specification for Filler Metals for Brazing and Braze Welding; American Welding Society.
- M. UL 429 Electrically Operated Valves; Underwriters Laboratories Inc..

# 1.04 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Liquid Indicators:
- C. Valves:
  - 1. Use service valves on suction and discharge of compressors.

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2. Use gage taps at compressor inlet and outlet.

# D. Strainers:

- 1. Use line size strainer upstream of each automatic valve.
- 2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.
- 3. Use shut-off valve on each side of strainer.
- E. Filter-Driers:
  - 1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
- F. Replaceable Cartridge Filter-Driers:
  - 1. Use filter-driers for each solenoid valve.

# 1.05 SUBMITTALS

- A. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.
- B. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

# 1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years ofdocumented experience.

### 1.07 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

# PART 2 PRODUCTS

#### 2.01 PIPING

- A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
  - 1. Fittings: ASME B16.22 wrought copper.
  - 2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
- B. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
  - 1. Fittings: ASME B16.26 cast copper.
  - 2. Joints: Flared.
- C. Pipe Supports and Anchors:
  - 1. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
  - 2. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
  - 4. Vertical Support: Steel riser clamp.
  - 5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  - 6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
  - 7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
  - 8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

#### 2.02 REFRIGERANT

- A. Refrigerant: R-134a, tetrafluoroethane as defined in ASHRAE Std 34.
  - 1. R-22: Monochlorodifluoromethane.

### 2.03 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

### 2.04 VALVES

- A. Diaphragm Packless Valves:
  - 1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.
- B. Packed Angle Valves:
  - 1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.
- C. Service Valves:
  - 1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

### 2.05 STRAINERS

- A. Straight Line or Angle Line Type:
  - 1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

#### 2.06 FILTER-DRIERS

- A. Manufacturers:
  - 1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com.
  - 2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com.
  - 3. Sporlan, a Division of Parker Hannifin: www.parker.com.
- B. Performance:
  - 1. Flow Capacity Liquid Line: 2 ton, minimum, rated in accordance with AHRI 710.
  - 2. Water Capacity: As indicated in schedule, rated in accordance with AHRI 710.
  - 3. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
  - 4. Design Working Pressure: 350 psi, minimum.
- C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.
- D. Construction: UL listed.
  - 1. Connections: As specified for applicable pipe type.

# 2.07 SOLENOID VALVES

- A. Valve: AHRI 760, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.
- B. Coil Assembly: UL 429, UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

# PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.02 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient. Pinping shall be concealed within the building structure except when shown to be in an "unfinished area" such as a mechanical room or attic.,
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.5.
  - 2. Support horizontal piping as scheduled.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 7. Provide copper plated hangers and supports for copper piping.
- G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- H. Provide clearance for installation of insulation and access to valves and fittings.
- I. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08-31-00.
- J. Flood piping system with nitrogen when brazing.
- K. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.
- L. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting.
- M. Insulate piping and equipment; refer to Section and Section 22-07-16.
- N. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.
- O. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.
- P. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.
- Q. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.
- R. Fully charge completed system with refrigerant after testing.

#### 3.03 FIELD QUALITY CONTROL

- A. See Section 01-40-00 Quality Requirements, for additional requirements.
- B. Test refrigeration system in accordance with ASME B31.5.
- C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

#### 3.04 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
  - 1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  - 4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

6. 2-5/8 inch OD: Maximum span, 9 feet; minimum rod size, 3/8 inch.

# SECTION 23-31-00 HVAC DUCTS AND CASINGS

### PART 1 GENERAL

### **1.01 SECTION INCLUDES**

- A. Metal ductwork.
- B. Casing and plenums.
- C. Duct cleaning.

# 1.02 RELATED REQUIREMENTS

- A. Section 23-07-13 Duct Insulation: External insulation and duct liner.
- B. Section 23-33-00 Air Duct Accessories.
- C. Section 23-37-00 Air Outlets and Inlets.

# 1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M Standard Specification for Carbon Structural Steel.
- B. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ICC-ES AC01 Acceptance Criteria for Expansion Anchors in Masonry Elements.
- E. ICC-ES AC106 Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.
- F. ICC-ES AC193 Acceptance Criteria for Mechanical Anchors in Concrete Elements.
- G. NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association.
- H. NFPA 90B Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; National Fire Protection Association.
- I. SMACNA (DCS) HVAC Duct Construction Standards Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.
- J. UL 181 Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc..

#### 1.04 SUBMITTALS

A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum \_\_\_\_ years of documented experience.

#### **1.06 FIELD CONDITIONS**

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

# PART 2 PRODUCTS

# 2.01 DUCT ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.
- B. All Ducts: Galvanized G-90 grade lock forming steel, unless otherwise indicated.
- C. Low Pressure Supply (System with Cooling Coils): 1/2 inch w.g. pressure class, galvanized steel.
- D. Return and Relief: 1/2 inch w.g. pressure class, galvanized steel.

- E. General Exhaust: 1/2 inch w.g. pressure class, galvanized steel.
- F. Outside Air Intake: 1/2 inch w.g. pressure class, galvanized steel.

# 2.02 MATERIALS

- A. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with G90/Z275 coating.
  - 1. Provide paint-grip finish for exposed ducts that are to be painted.
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
  - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
  - 2. VOC Content: Not more than 250 g/L, excluding water.
  - 3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
  - 4. For Use With Flexible Ducts: UL labeled.
- C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
  - 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
  - 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
  - 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
  - 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
- E. Insulated Flexible Ducts:
  - 1. Two ply vinyl film supported by helically wound spring steel wire; fiberglass insulation; aluminized vapor barrier film.
    - a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
    - b. Maximum Velocity: 4000 fpm.
    - c. Temperature Range: -10 degrees F to 160 degrees F.
- F. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
  - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and
  - compatible with substrates, and recommended by manufacturer for pressure class of ducts.
  - 2. VOC Content: Not more than 250 g/L, excluding water.
  - 3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.
  - 4. For Use With Flexible Ducts: UL labeled.
  - 5. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
- G. Hanger Rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

# 2.03 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. Duct systems have been designed with internal net free area dimensions stated on the plans. Where duct liner is installed, increase fabricated duct dimensions to allow for the total liner thickness.
- C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- E. Provide air foil turning vanes when rectangular elbows must be used.
- F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- G. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

H. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

# 2.04 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA (DCS) HVAC Duct Construction Standards Metal and Flexible, and as indicated. Provide duct material, gages,reinforcing, and sealing for operating pressures indicated.
- B. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).

# 2.05 CASINGS AND PLENUMS

- A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.
- B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gage, 0.0478 inch expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.
- C. Mount floor mounted casings on 4 inch high concrete curbs (in mechanical rooms only). At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of 18 gage galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.
- D. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
- E. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gage, 0.0598 inch sheet steel back facing and 22 gage, 0.0299 inch perforated sheet steel front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb/cu ft minimum glass fiber insulation media, on inverted channels of 16 gage, 0.0598 inch sheet steel.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install purchased items in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Duct sizes indicated are inside clear dimensions. For lined ducts, increase duct dimensions for fabrication to maintain sizes inside lining.
- E. Install and seal metal and flexible ducts in accordance with SMACNA (DCS) HVAC Duct Construction Standards Metal and Flexible.
- F. Support ductwork with corrosion resistant metal supports (i.e. galvanized steel). Do not use any fabric or plastic supports for permanent support of any ductwork. Fabric or plastic supports may be used as temporary supports only and shall be replaced with metal supports prior to project closeout.
- G. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- H. Provide duct access doors in ductwork where access to internal components (such as fire dampers, damper operators, etc) is required.
- I. Provide building access doors in walls or ceilings as required to gain access to the duct access door and internal component. Building access doors shall be constructed with piano type hinges and keyed locks and to match the appropriate fire rating (if any) of the wall or ceiling in which they are installed. Coordinate exact location and installation of access doors with the General Contractor.

- J. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- K. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- L. Use double nuts and lock washers on threaded rod supports.
- M. Connect diffusers or light troffer boots to low pressure ducts with 10 feet maximum length of flexible duct held in place with strap or clamp.
- N. Connect flexible ducts to metal ducts with drawbands and liquid adhesive plus tape.
- O. Do not use flexible ducts to penetrate walls. All wall penetrations shall be made with steel duct.
- P. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.
- Q. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- R. Provide temporary air filter media over each return and exhaust grille whenever the HVAC system is operated prior to final building cleanup. Coordinate with other contractors to insure that heavy dust generating activities have been completed before HVAC systems are operated in the building. Change the media as required to insure filtration of the air and the maintain airflow through the system without excessive pressure drop through the filter media.
- S. At exterior wall louvers, seal duct to louver frame and install blank-out panels.
- T. Route ductwork to avoid the space above electrical panelboards. Coordinate exact locations of panelboards with the Electrical Contractor prior to installing ductwork that will pass near the panelboards.

# 3.02 CLEANING

A. Clean duct systems, if construction debris is present in the system, with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

# 3.03 SCHEDULES

- A. Ductwork Material:
  - 1. Low Pressure Supply (System with Cooling Coils): Steel.
  - 2. Medium and High Pressure Supply: Steel.
  - 3. Return and Relief: Steel.
  - 4. General Exhaust: Steel.
  - 5. Outside Air Intake: Steel.
- B. Ductwork Pressure Class:
  - 1. Supply (System with Cooling Coils): 1 inch.
  - 2. Return and Relief: 1/2 inch.
  - 3. General Exhaust: 1/2 inch.
  - 4. Outside Air Intake: 1/2 inch.

# SECTION 23-33-00 AIR DUCT ACCESSORIES

#### PART 1 GENERAL

### **1.01 SECTION INCLUDES**

- A. Air turning devices/extractors.
- B. Backdraft dampers metal.
- C. Duct test holes.
- D. Flexible duct connections.
- E. Volume control dampers.

### 1.02 RELATED REQUIREMENTS

A. Section 23-31-00 - HVAC Ducts and Casings.

### 1.03 REFERENCE STANDARDS

- A. NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association.
- B. SMACNA (DCS) HVAC Duct Construction Standards Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

# 1.04 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

#### 1.05 PROJECT RECORD DOCUMENTS

A. Record actual locations of access doors and test holes.

### 1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

# PART 2 PRODUCTS

#### 2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Manufacturers:
  - 1. Carlisle HVAC Products: www.carlislehvac.com.
  - 2. Elgen Manufacturing: www.elgenmfg.com.
  - 3. Krueger: www.krueger-hvac.com.
  - 4. Ruskin Company: www.ruskin.com.
  - 5. Titus: www.titus-hvac.com.
  - 6. Ward Industries by Commercial Products Group of Hart & Cooley, Inc: www.wardind.com.
- B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.
- C. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

# 2.02 BACKDRAFT DAMPERS - METAL

# 2.03 BACKDRAFT DAMPERS

- A. Gravity Backdraft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free

manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

# 2.04 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, plastic plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

# 2.05 FLEXIBLE DUCT CONNECTIONS

- A. Manufacturers:
  - 1. Carlisle HVAC Products: www.carlislehvac.com.
  - 2. Elgen Manufacturing: www.elgenmfg.com.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Flexible Duct Connections: Fabric crimped into metal edging strip.
  - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
    - a. Net Fabric Width: Approximately 2 inches wide.
  - 2. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.
- D. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.
- E. Maximum Installed Length: 6 inch.

# 2.06 VOLUME CONTROL DAMPERS

- A. Manufacturers:
  - 1. Louvers & Dampers, Inc: www.louvers-dampers.com.
  - 2. Nailor Industries Inc: www.nailor.com.
  - 3. Ruskin Company: www.ruskin.com.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Splitter Dampers: Fabricate from thickest size ductwork that adjoins the splitter damper. Provide push-pull type operator in bronze sleeve guide and locking screw.
  - 1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
  - 2. Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
  - 3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw .
- D. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
  - 1. Fabricate for duct sizes up to 6 x 30 inch.
  - 2. Blade: 24 gage, 0.0239 inch, minimum.
- E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
  - 1. Blade: 18 gage, 0.0478 inch, minimum.
  - 2. Manufacturers:
- F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- G. Quadrants: Provide quadrant locking adjustment handles for multi-blade damper assemblies. Handle shall have "full-open" and "full-closed" markings with at least an additional 4 intermediate reference positions indicated

# 2.07 MISCELLANEOUS PRODUCTS

A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.

- 1. Thickness: 2 mils.
- 2. High tack water based adhesive.
- 3. UV stable light blue color.

# PART 3 EXECUTION

# 3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

# 3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23-31-00 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct test holes where indicated and required for testing and balancing purposes.
- D. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- E. Use splitter dampers only where indicated.
- F. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

# SECTION 23-34-23 POWER VENTILATORS

# PART 1 GENERAL

# **1.01 SECTION INCLUDES**

A. Ceiling exhaust fans.

# 1.02 RELATED REQUIREMENTS

A. Section 23-33-00 - Air Duct Accessories: Backdraft dampers.

### 1.03 REFERENCE STANDARDS

- A. AMCA (DIR) [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc..
- B. AMCA 99 Standards Handbook; Air Movement and Control Association International, Inc..
- C. AMCA 204 Balance Quality and Vibration Levels for Fans; Air Movement and Control Association International, Inc..
- D. AMCA 210 Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; Air Movement and Control Association International, Inc. (ANSI/AMCA 210, same as ANSI/ASHRAE 51).
- E. AMCA 300 Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc..
- F. AMCA 301 Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc..
- G. UL 705 Power Ventilators; Underwriters Laboratories Inc..

### 1.04 SUBMITTALS

- A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- B. Manufacturer's Instructions: Indicate installation instructions.
- C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

#### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

# **1.06 FIELD CONDITIONS**

# PART 2 PRODUCTS

# 2.01 MANUFACTURERS

- A. Greenheck: www.greenheck.com.
- B. Loren Cook Company: www.lorencook.com.
- C. PennBarry: www.pennbarry.com.

# 2.02 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: AMCA 204 Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Conform to AMCA 99.
- E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

# 2.03 CABINET AND CEILING EXHAUST FANS

- A. Performance and characteristics as scheduled on the plan.
- B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge. Provide solid state speed controller with direct drive fans for fan speed adjustment.
- C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
- D. Grille: Molded white plastic.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Hung Cabinet Fans:
  - 1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 22-05-48.
  - 2. Install flexible connections specified in Section 23-33-00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- C. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

# SECTION 23-37-00 AIR OUTLETS AND INLETS

#### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Diffusers.
- B. Registers/grilles.
- C. Louvers.

#### 1.02 REFERENCE STANDARDS

- A. ADC 1062: GRD Test Code for Grilles, Registers & Diffusers.
- B. AMCA 500-L Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc..
- C. ASHRAE Std 70 Method of Testing the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc..

#### 1.03 SUBMITTALS

- A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- B. Project Record Documents: Record actual locations of air outlets and inlets.

#### 1.04 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.

#### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

#### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Carnes, a division of Carnes Company Inc.: www.carnes.com.
- B. Hart & Cooley, Inc: www.hartandcooley.com.
- C. Krueger: www.krueger-hvac.com.
- D. Metalaire: www.metalaire.com
- E. Price Industries: www.price-hvac.com.
- F. Titus: www.titus-hvac.com.

#### 2.02 RECTANGULAR CEILING DIFFUSERS

- A. Type: Provide square and rectangular, multi-louvered diffuser to discharge air in room.
- B. Connections: As scheduled on drawings.
- C. Frame: Provide inverted T-bar type. In plaster ceilings, provide plaster frame and ceiling frame.
- D. Fabrication: Steel with baked enamel finish.
- E. As specifed on plans
- F. Color: white baked enamel unless noted otherwise..
- G. Accessories: Provide opposed blade volume control damper; removable core with damper adjustable from diffuser face.

#### 2.03 CEILING SUPPLY REGISTERS/GRILLES

A. As specifed on plans

- B. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.
- C. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
- D. Construction: Made of aluminum extrusions with factory enamel finish.
- E. Color: white baked enamel unless noted otherwise..
- F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

# 2.04 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. As specifed on plans
- B. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, horizontal face.
- C. Color: white baked enamel unless noted otherwise..
- D. Damper (for exhaust grilles): Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.
- E. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

# 2.05 LOUVERS

- A. As specifed on plans
- B. Type: 4 inch deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch square mesh screen over exhaust and 1/2 inch square mesh screen over intake.
- C. Fabrication: 12 gage, 0.1046 inch thick extruded aluminum, welded assembly, with factory prime coat finish.
- D. Color: As shown on the drawings.

# PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Provide mounting options compatible with element in which air distribution is mounted. Do not furnish screw holes for devices mounted in lay-in ceilings.
- D. Install countersunk mounting screws painted to match the flange color of the device. Do not use Tek screws in exposed applications.
- E. Provide square to round transitions as required to adapt the neck size to the duct runout size.
- F. Provide a 6" minimum height acoustically line plenum on return, exhaust, and transfer grilles to insure that the entire face of the grille is utilized for the passage of air through the grille.
- G. Install 6" minimum height acoustically lined plenum with 6" minimum elbow for return grilles installed in open plenum ceilings. The elbow opening into the ceiling plenum shall be 22x14 minimum size.
- H. Install diffusers to ductwork with air tight connection.
- I. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- J. Paint ductwork visible behind air outlets and inlets matte black.

# SECTION 23-40-00 HVAC AIR CLEANING DEVICES

#### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

A. Disposable panel filters.

### 1.02 REFERENCE STANDARDS

- A. AHRI 850 Performance Rating of Commercial and Industrial Air Filter Equipment; Air-Conditioning, Heating, and Refrigeration Institute.
- B. UL 900 Standard for Air Filter Units; Underwriters Laboratories Inc..

### 1.03 PERFORMANCE REQUIREMENTS

A. Conform to AHRI 850 Section 7.4.

### 1.04 SUBMITTALS

- A. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.
- B. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.
- D. Job Filter Listing: Provide a listing of all filters required by equipment installed on the job. The list shall include the quantity, type, and size of each filter for each piece of equipment utilitizing air filters as well as a total job summary listing the required quantity of each size filter required for the job. Indicate the recommended filter changing frequency for filters in the listing.

#### 1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

#### 1.06 EXTRA MATERIALS

A. Provide two sets of disposable panel filters for each application.

### PART 2 PRODUCTS

#### 2.01 FILTER MANUFACTURERS

- A. Subject to meeting the requirements of the project specifications, manufacturer's offering products that may be used on the project include but are not limited to the following:
  - 1. American Filtration IncNone: www.americanfiltration.com.
  - 2. AAF International/American Air FilterNone: www.aafintl.com..
  - 3. Camfil Farr CompanyNone: www.camfilfarr.com..

#### 2.02 DISPOSABLE PANEL FILTERS

- A. Media: UL 900 Class 2, pleated fiber blanket, wire mesh backing, factory sprayed with flameproof, non-drip, non-volatile adhesive.
- B. Performance Rating: 80%
  - 1. Face Velocity: 500 FPM.
  - 2. Initial Resistance: 0.15 inch WG.
  - 3. Recommended Final Resistance: 0.50 inches WG.
- C. Casing: Cardboard frame.

# PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install air cleaning devices in accordance with manufacturer's instructions.
- B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

- C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.
- D. Install temporary filter media over each return and exhaust grille for use during HVAC operation prior to final building cleanup. Coordinate with other contractors on the job to insure that HVAC systems are not put into operation until the building has been cleaned of accumulated dust and debris, and heavy dust producing activities have been completed. Change filter media as required during the construction period.

# SECTION 23-81-27

# SMALL SPLIT-SYSTEM HEATING AND COOLING

# PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Air-source heat pumps.
- B. Water-source heat pumps.
- C. Air cooled condensing units.
- D. Indoor ductless fan & coil units.
- E. Controls.

### 1.02 RELATED REQUIREMENTS

A. Section 26-27-17 - Equipment Wiring: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

### 1.03 REFERENCE STANDARDS

- A. AHRI 210/240 Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute.
- B. AHRI 520 Performance Rating of Positive Displacement Condensing Units; Air-Conditioning, Heating, and Refrigeration Institute.
- C. ASHRAE Std 23.1 Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..
- D. NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association.
- E. NFPA 90B Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; National Fire Protection Association.
- F. UL 207 Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Underwriters Laboratories Inc..

#### 1.04 SUBMITTALS

- A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- C. Design Data: Indicate refrigerant pipe sizing.
- D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- E. Project Record Documents: Record actual locations of components and connections.
- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

#### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

### 1.06 WARRANTY

- A. Provide three year manufacturers warranty for solid state ignition modules.
- B. Provide 1 year parts and labor waranty for entire system.
- C. Provide second through tenth year parts warranty for compressors.

# PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Carrier Corporation: www.carrier.com.
- B. Trane Inc: www.trane.com.
- C. Daiken/McQuay: www.daikinmcquay.com
- D. Water Furnace: www.waterfurnace.com

#### 2.02 SYSTEM DESIGN

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
  - 1. Heating and Cooling: Air-sourceWater-source electric heat pump located in outdoor unit with evaporator.
  - 2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
- B. Performance Requirements: See Drawings for additional requirements.
- C. Electrical Characteristics:
  - 1. See Drawings
  - 2. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Section 26-27-17.

# 2.03 INDOOR UNITS FOR DUCTLESS SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
  - 1. Location: Ceiling.
  - 2. Cabinet: Galvanized steel.
    - a. Finish: White.
  - 3. Fan: Line-flow fan direct driven by a single motor.
  - 4. Filter return air with washable, antioxidant pre-filter and a pleated anti-allergy enzyme filter.
- B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
  - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
  - 2. Manufacturer: System manufacturer.
- C. Remote Actuators:

#### 2.04 OUTDOOR UNITS

- A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
  - 1. Comply with AHRI 210/240.
  - 2. Refrigerant: R-410A.
  - 3. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
  - 4. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.
- B. Compressor: Hermetic, two speed 1800 and 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.
- C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
  - 1. Condenser Fans: Direct-drive propeller type.
- D. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
  - 1. Provide thermostatic expansion valves.

- 2. Provide heat pump reversing valves.
- E. Operating Controls:
  - 1. Control by room thermostat to maintain room temperature setting.
- F. Mounding Pad: Cast concrete 4" larger than unit in both plan dimensions. Pad shall extend at least 2" above grade. Pad shall be level.

# 2.05 ACCESSORY EQUIPMENT

- A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
  - 1. System selector switch (heat-off-cool) and fan control switch (auto-on).
  - 2. Automatic switching from heating to cooling.
  - 3. Preferential rate control to minimize overshoot and deviation from setpoint.
  - 4. Set-up for four separate temperatures per day.
  - 5. Instant override of setpoint for continuous or timed period from one hour to 31 days.
  - 6. Short cycle protection.
  - 7. Programming based on weekdays, Saturday and Sunday.
  - 8. Selection features including degree F or degree C display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.
  - 9. Battery replacement without program loss.
  - 10. Thermostat display:
    - a. Time of day.
    - b. Actual room temperature.
    - c. Programmed temperature.
    - d. Programmed time.
    - e. Duration of timed override.
    - f. Day of week.
      - g. System mode indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.

# 3.02 INSTALLATION

- A. Install in accordance with NFPA 90A and NFPA 90B.
- B. Support indoor units from building structure.
- C. Install outdoor unit on concrete housekeeping pad.
- D. Install refrigerant piping to each indoor unit. Conceal linesets in building constructio and insulate linesets as required.
- E. Braze linesets while flooding with dry nitrogen.
- F. Evacuate linesets and prove leakfree prior to introducing refrigeant.
- G. Provide full charge of refrigerant for all linesets and indoor units.
- H. Install condensate piping from unit condensate pump to disposal point.
- I. Install separate thermostat for control of each indoor unit.

# SECTION 26-05-05

#### COMMON ELECTRICAL REQUIREMENTS

# PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. General project related items that apply to all Division 26 sections. The provisions included in this section are complementary to and ammendatory of the Division 1 sections of these project specifications they do not replace them.
- B. This section contains project requirements applicable to the Electrical Contract as well as the Technology Contract for the project. The specifications are "integrated" and each section must be reviewed for applicable requirements for each trade.

#### 1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections apply to this section. Where conflicts may exist between Division 1 Specifications Sections and Division 26 Specification Sections, the Division 1 provisions shall take precedence except for when the Division 26 provisions expand, enhance, or extend the project, material or equipment requirements.

#### 1.03 REFERENCES

- A. FM P7825 Approval Guide; Factory Mutual .
- B. NEMA MG 1 Motors and Generators .
- C. NFPA 70 National Electrical Code.
- D. SSPC-Paint 15 Steel Joist Shop Paint; Steel Structures Painting Council .
- E. North Carolina State Building Code (All Volumes)
- F. Guilford County Schools Access Control System

#### 1.04 DEFINITIONS

- A. Building Code: Collectively, the current editions of all applicable codes whose requirements must be met in order for the Building Owner to be granted an Occupancy Permit by the authorities having jurisdiction over the building. These codes shall include but not be limited to the following specific volumes as well as any additional codes or standards referenced in these publications:
  - 1. General Construction.
  - 2. Administrative.
  - 3. Accessibility.
  - 4. Mechanical.
  - 5. Electrical.
  - 6. Fire Prevention.
  - 7. Gas.
  - 8. Energy.
- B. Contractor: A licensed individual, partnership, corporation or other business entity duly licensed in the State for the trade in which he is performing work or offering to perform work. The term "Contractor" shall apply to such entity regardless of whether the entity is working as a Prime Contractor or as a Sub Contractor on the project.
  - 1. Prime Contractor: A licensed individual, partnership, corporation or other business entity duly licensed in the State for the trade in which he is performing or offering to perform work and who is awarded a contract with the Owner for work on this project.
  - 2. Sub Contractor: A licensed individual, partnership, corporation or other business entity duly licensed in the State for the trade in which he is performing or offering to perform work and who is working on the project under contract with a Prime Contractor.
- C. Building Related Laws: Collectively, the current editions of all applicable laws whose requirements must be met in order for the Building Owner to provide access to the public and to occupy and conduct business lawfully including any additional laws, codes or standards referenced in these laws. These laws include but are not limited to the following:
- 1. Americans With Disabilities Act.
- 2. Energy Policy Act.
- D. Applicable version of referenced standards: Wherever standards are referenced throughout these specifications and on the drawings, the version applicable will be the year that is referenced in the current version of the Building Codes. Where later versions have been published, but not officially adopted into the current Building Codes, the later versions do not apply to this project.

#### 1.05 GENERAL PROJECT REQUIREMENTS

- A. The plans and specifications for this project are prepared to represent the general project requirements and intent. They are diagrammatic in nature and are not intended to show each and every fitting, offset, or other modifications or minor devices that may be required in the field to provide a complete system that is safe, efficient and effective in operation. Minor components or modifications that are required to provide a safe, efficient and effective system shall be included in the bid price whether or not they are specifically called for on the plans or in these specifications. It is understood that the contractors bidding this project are required to be licensed in their respective trade and are therefore knowlegable in the trade in which they are licensed.
- B. The Contractor shall provide all contingencies and supply all tools, fixtures, transportation, etc as well as materials necessary for installation. In all its details, the work and materials shall be subject to the approval of the Architect or Engineer whose decision on all points of difference shall be final and binding on this Contractor.
- C. The Contractor shall secure and pay for all necessary approvals, permits, inspections, certificates etc. required by state or local codes or statutes, rules, or regulations and pay all fees required unless specifically noted otherwise.
- D. All work and materials are required to be in compliance with State and Local Codes. Any conflicts between the plans and State or Local Codes, Rules, Statutes, or Regulations shall be brought to the Architect's or Engineer's attention in writing immediately.
- E. Plans are diagrammatic in nature and show the general design and arrangement of the systems. They are not intended to show each and every offset or fitting required for installation of work under this contract. This Contractor, as a licensed professional, is required to be proficient and knowledgeable in his trade and is required to include all such items and contingencies in his bid. The plans are not to be scaled for rough-in dimensions nor are they to be used for shop drawings.
  - 1. Where dimensions are given on the plans, they must be verified with actual field measurements taken on the project site. This Contractor shall take such field measurements as required to coordinate the installation of his work or to prepare shop drawings.
  - 2. Slight relocation of fixtures, equipment, devices and other items may be made by this Contractor as required to fit his work to casework, trim, brick coursing, etc as long as such relocation does not interfere with work of any other Contractor.

### **1.06 SYSTEM DESCRIPTION**

- A. Provide complete lighting and power distribution systems for the building including but not necessarily limited to the following:
  - 1. Provide temporary power for the site as required by this Contractor and other Contractors and Subcontractors on the project.
  - 2. Provide temporary telephone service for the site as required by this Contractor and other Contractors and Subcontractors on the project.
  - 3. Provide a new electrical service entrance to the building. The new service shall be <120/208 volt three phase, 4 wire> Coordinate all work with the local utility company that will be supplying power to the building to provide for proper metering and service installation.
  - 4. Provide new power distribution from the existing electrical distribution equipment to all new or modified systems and equipment requiring power connections in the building including but not necessarily limited to raceways, cables, conductors, panelboards, disconnect switches, starters, convenience outlets, special outlets for equipment, grounding and bonding systems.
  - 5. Provide new data pathways as indicated.
  - 6. Provide telephone <conduit system> in the building

# 1.07 COORDINATION OTHER DIVISIONS

A. Requirements noted in this division are intended to be supplementary to Division 1 requirements. Where Division 1 requirements exceed the requirements in this section, the Division 1 requirements shall govern. Where requirements in this section exceed Division 1 requirements, the requirements in this division shall govern. This Contractor is required to review the Division 1 requirements as well as other Divisions to allow coordination of his work with other trades.

# 1.08 PERFORMANCE REQUIREMENTS

- A. All equipment installed in fire rated walls, ceilings, or other partitions shall be listed to maintain the fire rating and shall be installed to maintain the rating.
- B. Materials (such as conduit) passing through fire rated walls, ceilings or other partitions shall be suitably firestopped using only approved materials and methods to maintain the fire rating of the assembly. Conform to UL Assembly details for the firestopping system installed for each application.
- C. Schedule all required inspections by State and Local Authorities, and make all corrections as required by such inspections.

### 1.09 SUBMITTALS

- A. Shop Drawings: Submit shop drawings as specified in the respective specification section. When equipment, materials or systems other than the one specified are submitted, this Contractor shall be required to clearly mark differences between the items submitted and the items specified. This Contractor shall be responsible for all changes required (including but not limited to piping, wiring, mounting, clearances, etc) under this and other divisions due to the use of items other than those specified.
  - 1. Shop drawings shall be submitted electronically in pdf format. Processed shop drawings will be returned electronically in pdf format.
  - 2. Submit shop drawings in one complete package and not at intervals.
  - 3. The Contractor shall check each submittal for accuracy and completeness prior to submitting the shop drawings to the Engineer. The Contractor shall stamp and sign the documents accordingly.
  - 4. Select and identify one product for each item that submitted. Multiple products will not be considered for an item.
  - 5. Each item being submitted for review shall be clearly identified in the submittal. In the event that multiple items are cataloged in a section and a single item is not clearly identified as the one that is being submitted, the Engineer may at his discretion select any suitable item from the page that meets or exceeds the requirements for the project.

## 1.10 QUALITY ASSURANCE

- A. Perform in accordance with state and local building codes, laws and ordinances .
- B. Obtain and pay for all inspections, permits, and fees required for work under this contract.
- C. Substitutions: Substitutions shall be made in accordance with the procedures given in the applicable Division 1 sections. The following procedures shall supplement the procedures given in Division 1. In the event that there are not substitution procedures given in Division 1, these procedures shall be used for all Division 23 and Division 26 items.
  - 1. When equipment, materials or systems other than the one specified are submitted, this Contractor shall be required to clearly mark differences between the items submitted and the items specified. This Contractor shall be responsible for all changes required (including but not limited to piping, wiring, mounting, clearances, etc) under this and other divisions due to the use of items other than those specified. The costs for these required changes shall be borne by the Contractor making the substitution at no additional costs to the Owner. The Engineer's decision on the acceptability of substitute equipment shall be final and binding under this contract. The acceptance of substitute items shall in no way relieve the Contractor from meeting any of the project requirements.
  - 2. Items that are to be substituted for a specified item shall be equal in quality, performance, capacity, size, construction, utility requirements, appearance, etc to the item specified.
  - 3. Substitutions may be made for all items specified using the term "or equal". Where an item is specified without the use of the term "or equal" that item must be used for the project bid. No substitutions may be made for items that are specified without the "or equal" term.

- 4. Items exceeding the performance, efficiency, quality, etc may be used when approved by the Engineer, but no additional money will be paid under the contract for such features.
- 5. The Engineer may consider qualities and characteristics of the specified item which may or may not have been specifically called out in the schedules or specifications when evaluating the suitability of a substitute item. The Engineer's decision regarding the acceptability of substitute items shall be final and binding under this contract.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience and properly licensed to perform the work.

### 1.11 DELIVERY, STORAGE, AND PROTECTION

- A. Store materials and equipment under cover and elevated above grade until ready for installation.
- B. Deliver materials and products to project site in their original shipping containers.

### 1.12 PROJECT CONDITIONS

- A. Coordinate equipment installation with size, location and installation of service utilities.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

### 1.13 WARRANTY

- A. All labor, materials, and products supplied on this project shall have a minimum of 1 year parts and labor replacement warranty.
- B. Consult individual specification sections for additional warranty requirements. Warranty requirements stated in the subsequent specifications sections are supplemental to requirements in this warranty section.
- C. Correct defective Work within a one year period after Date of Substantial Completion unless a different date is given in Division 1 specifications sections. Provide all materials, labor, supplies etc. as required to remove, disassemble, replace, reassemble, etc. failed or otherwise defective parts that are covered under the warranty terms.

### 1.14 MAINTENANCE SERVICE

A. Provide service and maintenance of all equipment installed under this contract for 12 months from Date of Substantial Completion.

## PART 2 PRODUCTS

## 2.01 GENERAL

- A. All materials and products shall be new and shall comply with the requirements of the North Carolina State Building Code and the NFPA 70 (National Electrical Code) with North Carolina Amendments.
- B. All materials and products shall be UL or other acceptable listing agency listed where such listing is available for the material used. Where a listing is not available, materials shall be appropriately selected for their intended use.
- C. All materials and products shall be the appropriate type for the installed location.
- D. Hazardous (Classified) locations: In accordance with the appropriate section of Article 500 of NFPA 70.
- E. Where not specifically noted otherwise on the plans, enclosures for electrical equipment shall be as follows:
  - 1. Indoors, in clean environments: NEMA 1 rated, Heavy Duty.
  - 2. Outdoors, exposed to the weather: NEMA 3R rated, Heavy Duty.
  - 3. Hazardous (Classified) locations: In accordance with the appropriate section of Article 500 of NFPA 70.
- F. Lighting fixtures shall be supplied complete with lamps, ballasts, lenses (unless the fixture specified is an open type fixture), thermal protection, trim appropriate for the surface that the fixture is mounted on or in and supports as required to support the fixture from the building structure.
- G. Control devices (starters) shall be supplied complete with thermal overload elements, Hand-Off-Auto switches, control coils of the appropriate coil voltage for the application, enclosure, fuses (when the starter is part of a combination starter/disconnect unit), and indicating lights indicating when the load is energized.

- H. Non-fusible disconnect switches shall be furnished complete with operator handles, enclosures, fuses sized for the load or the nameplate data of the equipment supplied,
- I. Fusible disconnect switches shall be furnished complete with operator handles, enclosures, fuses sized for the load or the nameplate data of the equipment supplied.
- J. Materials and equipment of a similar type shall be supplied by the same manufacturer where possible. Do not provide similar products from two or more manufacturers unless a highly specialized item without equal has been specified. Do not provide similar products from two or more manufacturers if the items must fit together to provide their intended function.
- K. Manufacturers specified are to establish the quality, performance, and appearance level desired for the project. Equivalent items by other manufacturers are acceptable as substitutions provided the items are judged equal in the applicable characteristics by the Engineer.
- L. Junction boxes and pull boxes shall be provided as required for installation and to meet code requirements. Field conditions and routing of conduits can require additional boxes based on job conditions. The plans are diagrammatic in nature and do not intend to show all junction boxes and pull boxes that may be required.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that the building and site conditions are in the proper stage of construction for the installation of electrical materials and equipment prior to installing such equipment. Do not install electrical equipment when it would be subject to damage from the elements or vandalism due to an unsecured building.
- B. Verify that proper installation and service clearance is available in the intended location of electrical equipment prior to installing equipment.

#### 3.02 INSTALLATION

- A. Install all equipment and materials in accordance with manufacturer's instructions, the UL listing, and all State and Local codes and Ordinances.
- B. Schedule all required inspections with authorities having jurisdiction over the project and make corrections as required by such inspections.
- C. Coordinate rough-in of convenience outlets, light switches, fire alarm devices, etc with the requirements of the Americans With Disabilities Act requirements.
- D. Make electrical connections to equipment provided by other contractors. Coordinate with the equipment to determine the point of connection. Use fittings to secure conduit to equiment. Do not route flexible conduit through equipment casings. Allow for equipment to be installed withing 10' of the actual locations indicated on the plans.
- E. Identify all panelboards, disconnect switches, starters, etc with engraved phenolic labels permanently affixed to the cover with screws, rivets adhesive attached labels are not permitted. Identify the equipment by mark, the voltage, and the source of power serving the equipment.
- F. Identity receptacles, switches, and emergency lighting units with the panelboard and the circuit number of the branch circuit feeding the receptacle. Label with adhsesive backed clear label with black lettering. Install labels on the front of receptacle coverplates. Install labels for switches on the back side (concealed to view) of the switch coverplate.
- G. Provide all cutting and patching as required for installation of materials or equipment under this contract except where specifically noted otherwise on the plans.
- H. Provide all trenching and backfilling required for installation of work in this project. Backfill in 8" lifts and compact to 95% proctor unless a different compaction level is listed on the plan or in the earthwork sections of the specifications. Seed and straw disturbed grass areas. Patch disturbed paved areas equal to the adjacent paving. Provide new mulch for disturbed mulched areas.
- I. Where applicable, provide all demolition, disassembly, removal, transportation, and legal disposal of existing items that are not being reused or salvaged.

#### 3.03 INTERFACE WITH OTHER WORK

- A. This Contractor shall coordinate his work with that of all other Contractors on the project and shall consult the drawings and specifications of the other trades to determine the nature and effect of work by others. This Contractor shall be responsible for all his work fitting in place with in an approved manner, and shall consult with others as required for drawings, dimensions, elevations, actual building measurements, etc. as necessary to insure that his work fits properly and does not conflict with other trades.
- B. In the event that interferences develop, this Contractor shall cooperate with others to eliminate the interference. Should pipes, ductwork, conduit, equipment or other items have to be relocated, the Architect's or Engineer's decision will be the final authority as to which Contractor shall relocate his work.
- C. Consult the kitchen equipment shop drawings to determine exact rough-in and connection locations for kitchen equipment.
- D. Coordinate actual devices to be supplied for connection to equipment installed by other Contractors, Subcontractors or Owner on the project.
- E. Coordinate voltage and current characteristics of all equipment installed by other Contractors, Subcontractors or Owner on the project. Coordinate with the actual equipment that is installed.
- F. Coordinate with other contractors on the project to avoid routing of pipes, ducts, etc over panelboards and within the clearance requirements of other gear.
- G. Make power connections to all equipment installed by other Contractors, Subcontractors or Owner on the project.
- H. Provide all cutting and patching as required for installation of materials or equipment under this contract, except where specifically noted otherwise on the plans.
- I. Where applicable, provide all demolition, disassembly, removal, transportation, and legal disposal of existing items that are not being reused or salvaged.

#### 3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing to insure equipment, conductors, etc are installed proprely and without defects that would cause short circuits, open neutrals, floating neutrals, non-continuous bonding, inadeuate fault currents, etc.
- B. Thorughly inspect equipment installed on thes project for proper installation, settings and adjustment prior to energizing. Replace all defective or damaged items found.

#### 3.05 STARTING EQUIPMENT AND SYSTEMS

- A. Provide manufacturer's field representative to prepare and start equipment and systems where so specified. Where not specified, start equipment and systems in accordance with the manufacturer's instructions and recommendations. Provide all test instruments, power, personnel and materials as required to start the equipment and systems.
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner 's designated representative.

#### 3.06 ADJUSTING

A. Adjust equipment and systems for safe and efficient operation.

#### 3.07 CLEANING

- A. Clean all equipment prior to substantial completion.
- B. Protect installed equipment and materials from subsequent construction operations.
- C. Do not permit traffic over unprotected floor surface.

### END OF SECTION

### SECTION 26-05-19

#### LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

# PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wire and cable for 600 volts and less.
- D. Wiring connectors.
- E. Electrical tape.
- F. Heat shrink tubing.
- G. Wire pulling lubricant.

### 1.02 RELATED REQUIREMENTS

- A. Section 07-84-00 Firestopping.
- B. Section 26-05-26 Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- C. Section 26-05-53 Identification for Electrical Systems: Identification products and requirements.

### 1.03 REFERENCE STANDARDS

- A. ASTM B3 Standard Specification for Soft or Annealed Copper Wire.
- B. ASTM B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
- C. ASTM B33 Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.
- D. ASTM B787/B787M Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation.
- E. ASTM D3005 Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.
- F. ASTM D4388 Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes.
- G. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- H. NECA 120 Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); National Electrical Contractors Association (NECA/NACMA 102).
- I. NEMA WC 70 Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; National Electrical Manufacturers Association (ANSI/NEMA WC 70/ICEA S-95-658).
- J. NETA ATS Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association (ANSI/NETA ATS).
- K. NFPA 70 National Electrical Code; National Fire Protection Association.
- L. UL 44 Thermoset-Insulated Wires and Cables.
- M. UL 83 Thermoplastic-Insulated Wires and Cables.
- N. UL 486A-486B Wire Connectors.
- O. UL 486C Splicing Wire Connectors.
- P. UL 486D Sealed Wire Connector Systems.
- Q. UL 510 Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.
- R. UL 1569 Metal-Clad Cables.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed. Sequence work so that equipment requirements are verified, connections are made and checked to be ready when the equipment startup is needed.
  - 3. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
  - 4. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- B. Product Data: Provide for each cable assembly type.
- C. Field Quality Control Test Reports.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.
- F. Project Record Documents: Record actual locations of components and circuits.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

#### 1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Engineer and obtain direction before proceeding with work.

#### PART 2 PRODUCTS

#### 2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Service entrance cable is not permitted.
- F. Armored cable is not permitted.
- G. Metal-clad cable is permitted only as follows:

- 1. Where not otherwise restricted, may be used:
  - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
    - 1) Maximum Length: 6 feet.
  - b. Connection to indoor equipment (6' max length)..
- H. Connections to individual lighting fixtures above accessible ceilings(fixture whips): Use building wire in raceway or metal clad cable.

## 2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide new conductors and cables manufactured not more than one year prior to installation.
- D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- E. Comply with NEMA WC 70.
- F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- H. Conductors for Grounding and Bonding: Also comply with Section 26-05-26.
- I. Conductor Material:
  - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
  - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.
  - 3. Tinned Copper Conductors: Comply with ASTM B33.
- J. Minimum Conductor Size:
  - 1. Branch Circuits: 12 AWG.
    - a. Exceptions:
      - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
      - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
  - 2. Control Circuits: 14 AWG.
- K. Conductor Color Coding:
  - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
  - 2. Color Coding Method: Integrally colored insulation.
  - 3. Color Code:
    - a. Equipment Ground, All Systems: Green.

## 2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:
  - 1. Feeders and Branch Circuits:
    - a. Size 10 AWG and Smaller: Solid.
    - b. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation:
  - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
- E. Insulation: NFPA 70, Type THHN/THWN.

## 2.04 METAL-CLAD CABLE

A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

- B. Conductor Stranding:
  - 1. Size 10 AWG and Smaller: Solid.
  - 2. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- E. Grounding: Full-size integral equipment grounding conductor.
- F. Armor: Steel, interlocked tape.

### 2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26-05-26.
- C. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
  - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
  - 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
  - 5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
  - 6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
  - 7. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
  - 1. Manufacturers:
    - a. 3M: www.3m.com.
    - b. Ideal Industries, Inc: www.idealindustries.com.
    - c. NSI Industries LLC: www.nsiindustries.com.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
  - 1. Manufacturers:
    - a. Burndy: www.burndy.com.
    - b. Ilsco: www.ilsco.com.
    - c. Thomas & Betts Corporation: www.tnb.com.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
  - 1. Manufacturers:
    - a. Burndy: www.burndy.com.
    - b. Ilsco: www.ilsco.com.
    - c. Thomas & Betts Corporation: www.tnb.com.
- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

- 1. Manufacturers:
  - a. Burndy: www.burndy.com.
  - b. Ilsco: www.ilsco.com.
  - c. Thomas & Betts Corporation: www.tnb.com.

### 2.06 WIRING ACCESSORIES

A. Electrical Tape:

1.

- Manufacturers:
  - a. 3M: www.3m.com.
- b. Plymouth Rubber Europa: www.plymouthrubber.com.
- 2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
- Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
- 4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
- 5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
- 6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
- 7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
  - 1. Manufacturers:
    - a. 3M: www.3m.com.
    - b. Burndy: www.burndy.com.
    - c. Thomas & Betts Corporation: www.tnb.com.
- C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
  - 1. Manufacturers:
    - a. 3M: www.3m.com.
    - b. American Polywater Corporation: www.polywater.com.
    - c. Ideal Industries, Inc: www.idealindustries.com.

# PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that raceway installation is complete and supported.
- E. Verify that field measurements are as shown on the drawings.
- F. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

A. Insure that dirt, trash and all other foreign materials have been cleared from raceway before installing wire.

#### 3.03 INSTALLATION

- A. Circuiting Requirements:
  - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
  - 2. When circuit destination is indicated and routing is not shown, determine exact routing required.
  - 3. Arrange circuiting to minimize splices.
  - 4. Include circuit lengths required to install connected devices within 10 ft of location shown.
  - 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
  - 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
  - 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is permitted, under the following conditions:
    - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
    - b. Increase size of conductors as required to account for ampacity derating.
    - c. Size raceways, boxes, etc. to accommodate conductors.
  - 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.
- E. Installation in Raceway:
  - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
  - 2. Pull all conductors and cables together into raceway at same time.
  - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
  - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
  - 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- H. Terminate cables using suitable fittings.
  - 1. Metal-Clad Cable (Type MC):
    - a. Use listed fittings.
    - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- I. Install conductors with a minimum of 12 inches of slack at each outlet.
- J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- M. Make wiring connections using specified wiring connectors.
  - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

- 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
- 3. Do not remove conductor strands to facilitate insertion into connector.
- 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
- 5. Use hydraulic pressure connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
- 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- 8. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps for 10 AWG and smaller conductors.
- N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
  - 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
    - b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
  - 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
    - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
  - 3. Wet Locations: Use heat shrink tubing.
- O. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- P. Clean conductor surfaces before installing lugs and connectors.
- Q. Insulate ends of spare conductors using vinyl insulating electrical tape.
- R. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- S. Identify conductors and cables in accordance with Section 26-05-53.
- T. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07-84-00.
- U. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
- V. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps for 10 AWG and smaller conductors.

## 3.04 FIELD QUALITY CONTROL

- A. See Section 01-40-00 Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
  - 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

# END OF SECTION

### SECTION 26-05-26

### **GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

## PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.
- F. Chemically-enhanced ground electrodes.
- G. Ground enhancement material.
- H. Ground access wells.

### 1.02 RELATED REQUIREMENTS

- A. Section 26-05-19 Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 26-05-53 Identification for Electrical Systems: Identification products and requirements.

### 1.03 REFERENCE STANDARDS

- A. IEEE 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System; Institute of Electrical and Electronic Engineers.
- B. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- C. NEMA GR 1 Grounding Rod Electrodes and Grounding Rod Electrode Couplings; National Electrical Manufacturers Association.
- D. NETA ATS Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association (ANSI/NETA ATS).
- E. NETA STD ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association.
- F. NFPA 70 National Electrical Code; National Fire Protection Association.
- G. UL 467 Grounding and Bonding Equipment.

### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Verify exact locations of underground metal water service pipe entrances to building.
  - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
  - 3. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

### 1.05 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms.

### 1.06 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- B. Product Data: Provide for grounding electrodes and connections.

- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

## 1.07 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

## PART 2 PRODUCTS

### 2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
  - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Engineer. Precipitation within the previous 48 hours does not constitute normally dry conditions.
  - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

### E. Grounding Electrode System:

- 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
  - a. Provide continuous grounding electrode conductors without splice or joint.
  - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
- 2. Metal Underground Water Pipe(s):
  - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
  - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
  - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
- 3. Metal Building or Structure Frame:
  - a. Provide connection to metal building or structure frame effectively grounded in accordance with NFPA 70 at nearest accessible location.
- 4. Concrete-Encased Electrode:
  - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
- 5. Ground Rod Electrode(s):

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- a. Provide two electrodes unless otherwise indicated or required.
- b. Space electrodes not less than 10 feet from each other and any other ground electrode.
- c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
- d. Provide ground access well equal to equal to Erico T416B for each electrode.
- 6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
- F. Service-Supplied System Grounding:
  - 1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
  - 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- G. Separately Derived System Grounding:
  - 1. Separately derived systems include, but are not limited to:
    - a. Uninterruptible power supplies (UPS), when configured as separately derived systems.
    - b. Generators, when neutral is switched in the transfer switch.
  - 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
  - 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
  - 4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
  - 5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
  - 6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
  - 7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- H. Bonding and Equipment Grounding:
  - 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
  - 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
  - 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
  - 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  - 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
  - 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

- 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
  - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
  - b. Metal gas piping.
- 8. Provide bonding for metal building frame where not used as a grounding electrode.
- 9. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
- I. Communications Systems Grounding and Bonding:
  - 1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
  - 2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
    - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
    - b. Raceway Size: 3/4 inch unless otherwise indicated or required.
    - c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
    - d. Ground Bar Mounting Height: 48 above finished floor unless otherwise indicated.

### 2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
  - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
  - 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26-05-26:
  - 1. Use insulated copper conductors unless otherwise indicated.
    - a. Exceptions:
      - 1) Use bare copper conductors where installed underground in direct contact with earth.
      - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
  - 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
  - 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
  - 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
  - 4. Manufacturers Mechanical and Compression Connectors:
    - a. Advanced Lightning Technology (ALT): www.altfab.com.
    - b. Burndy: www.burndy.com.
    - c. Harger Lightning & Grounding: www.harger.com.
    - d. Thomas & Betts Corporation: www.tnb.com.
  - 5. Manufacturers Exothermic Welded Connections:
    - a. Burndy: www.burndy.com.
    - b. Cadweld, a brand of Erico International Corporation: www.erico.com.
    - c. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com.
- D. Ground Bars:
  - 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
  - 2. Size: 24x2x1/4 unless otherwise indicated or required.
  - 3. Holes for Connections: As indicated or as required for connections to be made.
  - 4. Manufacturers:
    - a. Advanced Lightning Technology (ALT): www.altfab.com.
    - b. Erico International Corporation: www.erico.com.
    - c. Harger Lightning & Grounding: www.harger.com.
    - d. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com.
- E. Ground Rod Electrodes:
  - 1. Comply with NEMA GR 1.

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- 2. Material: Copper-bonded (copper-clad) steel.
- 3. Size: 3/4 inch diameter by 8 feet length, unless otherwise indicated.
- 4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
- 5. Manufacturers:
  - a. Advanced Lightning Technology (ALT): www.altfab.com.
  - b. Erico International Corporation: www.erico.com.
  - c. Galvan Industries, Inc: www.galvanelectrical.com.
  - d. Harger Lightning & Grounding: www.harger.com.
- F. Chemically-Enhanced Ground Electrodes:
  - 1. Description: Copper tube factory-filled with electrolytic salts designed to provide a low-impedance ground in locations with high soil resistivity; straight (for vertical installations) or L-shaped (for horizontal installations) as indicated or as required.
  - 2. Length: 10 feet.
  - 3. Integral Pigtail: Factory-attached, sized not less than grounding electrode conductor to be attached.
  - 4. Backfill Material: Grounding enhancement material recommended by electrode manufacturer.
  - 5. Manufacturers:
    - a. Advanced Lightning Technology (ALT): www.altfab.com.
    - b. Erico International Corporation: www.erico.com.
    - c. Harger Lightning & Grounding: www.harger.com.
    - d. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com.
- G. Ground Enhancement Material:
  - 1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.
  - 2. Resistivity: Not more than 20 ohm-cm in final installed form.
  - 3. Manufacturers:
    - a. Erico International Corporation: www.erico.com.
    - b. Harger Lightning & Grounding: www.harger.com.
    - c. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com.
- H. Ground Access Wells:
  - 1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
  - 2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
    - a. Round Wells: Not less than 8 inches in diameter.
    - b. Rectangular Wells: Not less than 12 by 12 inches.
  - 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
  - 4. Cover: Factory-identified by permanent means with word "GROUND".
  - 5. Manufacturers:
    - a. Advanced Lightning Technology (ALT): www.altfab.com.
    - b. Erico International Corporation: www.erico.com.
    - c. Harger Lightning & Grounding: www.harger.com.
    - d. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com.

## PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as shown on the drawings.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify existing conditions prior to beginning work.
- E. Verify that final backfill and compaction has been completed before driving rod electrodes.

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### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
  - 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade. Provide ground rod protection enclosure/inspection well equal to Erico T416Bat each ground rod
  - 2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.
  - 3. Provide 2 ground rod electrodes unless a resistance of 25 ohms or less is obtained with one.
- D. Make grounding and bonding connections using specified connectors.
  - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
  - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26-05-53.
- F. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.
- G. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder raceway. This includes feeders to all panelboards and equipment. Terminate each end on suitable lug, bus, or bushing. Individual branch circuits only may utilize a conduit grounding system.

### 3.03 FIELD QUALITY CONTROL

- A. See Section 01-40-00 Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

### END OF SECTION

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### SECTION 26-05-29

### HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

## PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

#### 1.02 RELATED REQUIREMENTS

- A. Section 03-30-00 Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26-05-34 Conduit: Additional support and attachment requirements for conduits.
- C. Section 26-05-37 Boxes: Additional support and attachment requirements for boxes.
- D. Section 26-51-00 Interior Lighting: Additional support and attachment requirements for interior luminaires.
- E. Section 26-56-00 Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

#### 1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM B633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- D. MFMA-4 Metal Framing Standards Publication; Metal Framing Manufacturers Association.
- E. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- F. NFPA 70 National Electrical Code; National Fire Protection Association.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
  - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
  - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  - 5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03-30-00.

#### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
- B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

#### 1.06 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
  - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
  - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
  - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of \_\_\_\_\_. Include consideration for vibration, equipment operation, and shock loads where applicable.
  - 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
  - 5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
  - 6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
    - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
  - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
  - 2. Conduit Clamps: Bolted type unless otherwise indicated.
  - 3. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    - b. Erico International Corporation: www.erico.com.
    - c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
  - 1. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    - b. Erico International Corporation: www.erico.com.
    - c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    - d. Thomas & Betts Corporation: www.tnb.com.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
  - 1. Comply with MFMA-4.
  - 2. Channel Material:
  - 3. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
  - 4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
  - 5. Manufacturers:

1.

- a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
- b. Thomas & Betts Corporation: www.tnb.com.
- c. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
- d. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
  - Minimum Size, Unless Otherwise Indicated or Required:
  - a. Equipment Supports: 1/2 inch diameter.
  - b. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.
  - c. Single Conduit larger than 1 inch (27mm) trade size: 3/8 inch diameter.
  - d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.

- e. Outlet Boxes: 1/4 inch diameter.
- f. Luminaires: 1/4 inch diameter.
- F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
  - 1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  - 2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
  - 3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
  - 4. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
    - b. Erico International Corporation: www.erico.com.
    - c. PHP Systems/Design: www.phpsd.com.
    - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
- G. Anchors and Fasteners:
  - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
  - 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
  - 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
  - 4. Hollow Masonry: Use toggle bolts.
  - 5. Hollow Stud Walls: Use toggle bolts.
  - 6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
  - 7. Sheet Metal: Use sheet metal screws.
  - 8. Wood: Use wood screws.
  - 9. Hammer-driven anchors and fasteners are permitted only as follows:
    - a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction (when specified).
  - 10. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    - a. Comply with MFMA-4.
    - b. Channel Material: Use galvanized steel.
    - c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch minimum base metal thickness.
    - d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

### 2.02 MATERIALS

- A. Hangers, Supports, Anchors, and Fasteners General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Supports: Fabricated of structural steel or formed steel members; galvanized.
- C. Anchors and Fasteners:
  - 1. Do not use powder-actuated anchors.
  - 2. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
  - 3. Concrete Surfaces: Use expansion anchors.
  - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
  - 5. Solid Masonry Walls: Use expansion anchors or preset inserts.
  - 6. Sheet Metal: Use sheet metal screws.
  - 7. Wood Elements: Use wood screws.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Engineer, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Engineer, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Conduit Support and Attachment: Also comply with Section 26-05-34.
- I. Box Support and Attachment: Also comply with Section 26-05-37.
- J. Interior Luminaire Support and Attachment: Also comply with Section 26-51-00.
- K. Exterior Luminaire Support and Attachment: Also comply with Section 26-56-00.
- L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- M. Secure fasteners according to manufacturer's recommended torque settings.
- N. Remove temporary supports.
- O. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

### 3.03 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.
- D. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
  - 1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
  - 2. Obtain permission from Engineer before drilling or cutting structural members.
- E. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- F. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- G. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.
- H. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

### **END OF SECTION**

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Aluminum rigid metal conduit (RMC).
- C. Intermediate metal conduit (IMC).
- D. PVC-coated galvanized steel rigid metal conduit (RMC).
- E. Flexible metal conduit (FMC).
- F. Liquidtight flexible metal conduit (LFMC).
- G. Electrical metallic tubing (EMT).
- H. Rigid polyvinyl chloride (PVC) conduit.
- I. Liquidtight flexible nonmetallic conduit (LFNC).
- J. Conduit fittings.
- K. Accessories.
- L. Conduit, fittings and conduit bodies.

#### 1.02 RELATED REQUIREMENTS

- A. Section 03-30-00 Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 26-05-26 Grounding and Bonding for Electrical Systems.
  - 1. Includes additional requirements for fittings for grounding and bonding.
- C. Section 26-05-29 Hangers and Supports for Electrical Systems.
- D. Section 26-05-37 Boxes.
- E. Section 26-05-53 Identification for Electrical Systems: Identification products and requirements.
- F. Section 26-21-00 Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
- G. Section 27-10-05 Structured Cabling for Voice and Data Inside-Plant: Additional requirements for communications systems conduits.

#### 1.03 REFERENCE STANDARDS

- A. ANSI C80.1 American National Standard for Electrical Rigid Steel Conduit (ERSC).
- B. ANSI C80.3 American National Standard for Steel Electrical Metallic Tubing (EMT).
- C. ANSI C80.5 American National Standard for Electrical Rigid Aluminum Conduit (ERAC).
- D. ANSI C80.6 American National Standard for Electrical Intermediate Metal Conduit (EIMC).
- E. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- F. NECA 101 Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association.
- G. NECA 102 Standard for Installing Aluminum Rigid Metal Conduit; National Electrical Contractors Association.
- H. NECA 111 Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); National Electrical Contractors Association.
- I. NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association (ANSI/NEMA FB 1).
- J. NEMA RN 1 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association.
- K. NEMA TC 2 Electrical Polyvinyl Chloride (PVC) Conduit; National Electrical Manufacturers Association.

- L. NEMA TC 3 Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association.
- M. NFPA 70 National Electrical Code; National Fire Protection Association.
- N. UL 1 Flexible Metal Conduit.
- O. UL 6 Electrical Rigid Metal Conduit-Steel.
- P. UL 6A Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel.
- Q. UL 360 Liquid-Tight Flexible Steel Conduit.
- R. UL 514B Conduit, Tubing, and Cable Fittings.
- S. UL 651 Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
- T. UL 797 Electrical Metallic Tubing-Steel.
- U. UL 1242 Electrical Intermediate Metal Conduit-Steel.
- V. UL 1660 Liquid-Tight Flexible Nonmetallic Conduit.

## 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
  - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
  - 5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

## 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- B. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.
- C. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, and conduit bodies.

## 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

# PART 2 PRODUCTS

### 2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
  - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
  - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
  - 3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
  - 4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
  - 5. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
- D. Embedded Within Concrete:
  - 1. Within Slab on Grade: Not permitted.
  - 2. Within Slab Above Ground: Not permitted.
  - 3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
  - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
  - 1. Locations subject to physical damage include, but are not limited to:
    - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
    - b. Where exposed below 20 feet in warehouse areas.
- K. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.
- L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- M. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit or aluminum rigid metal conduit.
  - 1. Corrosive locations include, but are not limited to:
    - a. Cooling towers.

- N. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), aluminum rigid metal conduit, or PVC-coated galvanized steel rigid metal conduit.
- O. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
  1. Maximum Length: 6 feet.
- P. Connections to Vibrating Equipment:
  - 1. Dry Locations: Use flexible metal conduit.
  - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
  - 3. Maximum Length: 6 feet unless otherwise indicated.
  - 4. Vibrating equipment includes, but is not limited to:
    - a. Transformers.
    - b. Motors.
- Q. Fished in Existing Walls, Where Necessary: Use flexible metal conduit or metal clad cable assembly with dedicated ground conductor.

### 2.02 CONDUIT REQUIREMENTS

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.
- B. Electrical Service Conduits: Also comply with Section 26-21-00.
- C. Communications Systems Conduits: Also comply with Section 27-10-05.
- D. Fittings for Grounding and Bonding: Also comply with Section 26-05-26.
- E. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- F. Provide products listed, classified, and labeled as suitable for the purpose intended.
- G. Minimum Conduit Size, Unless Otherwise Indicated:
  - 1. Branch Circuits: 1/2 inch (16 mm) trade size.
  - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
  - 3. Control Circuits: 1/2 inch (16 mm) trade size.
  - 4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
  - 5. Underground, Interior: 3/4 inch (21 mm) trade size.
  - 6. Underground, Exterior: 1 inch (27 mm) trade size.
- H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

### 2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
  - 1. Allied Tube & Conduit: www.alliedeg.com.
  - 2. Republic Conduit: www.republic-conduit.com.
  - 3. Wheatland Tube Company: www.wheatland.com.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: www.bptfittings.com.
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    - c. Thomas & Betts Corporation: www.tnb.com.
  - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
  - 4. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.

5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

### 2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
  - 1. Allied Tube & Conduit: www.alliedeg.com.
  - 2. Republic Conduit: www.republic-conduit.com.
  - 3. Wheatland Tube Company: www.wheatland.com.
- B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: www.bptfittings.com.
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    - c. Thomas & Betts Corporation: www.tnb.com.
  - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
  - 4. Material: Use aluminum.
  - 5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

## 2.05 INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
  - 1. Allied Tube & Conduit: www.alliedeg.com.
  - 2. Republic Conduit: www.republic-conduit.com.
  - 3. Wheatland Tube Company: www.wheatland.com.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: www.bptfittings.com.
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    - c. Thomas & Betts Corporation: www.tnb.com.
  - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
  - 4. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
  - 5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

# 2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
  - 1. Allied Tube & Conduit.
  - 2. Thomas & Betts Corporation: www.tnb.com.
  - 3. Robroy Industries: www.robroy.com.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.
- D. Interior Coating: Urethane, minimum thickness of 2 mil.
- E. PVC-Coated Fittings:

- 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
- 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
- 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
- 4. Material: Use steel or malleable iron.
- 5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
- 6. Interior Coating: Urethane, minimum thickness of 2 mil.
- F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

### 2.07 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc: www.afcweb.com.
  - 2. Electri-Flex Company: www.electriflex.com.
  - 3. International Metal Hose: www.metalhose.com.
- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: www.bptfittings.com.
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    - c. Thomas & Betts Corporation: www.tnb.com.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
- D. Description: Interlocked steel construction.
- E. Fittings: NEMA FB 1.

## 2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc: www.afcweb.com.
  - 2. Electri-Flex Company: www.electriflex.com.
  - 3. International Metal Hose: www.metalhose.com.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: www.bptfittings.com.
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    - c. Thomas & Betts Corporation: www.tnb.com.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
- D. Description: Interlocked steel construction with PVC jacket.
- E. Fittings: NEMA FB 1.

### 2.09 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
  - 1. Allied Tube & Conduit: www.alliedeg.com.
  - 2. Republic Conduit: www.republic-conduit.com.
  - 3. Beck Manufacturing, Inc.
  - 4. Wheatland Tube Company: www.wheatland.com.

- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: www.bptfittings.com.
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    - c. Thomas & Betts Corporation: www.tnb.com.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
  - 4. Connectors and Couplings: Use compression (gland) or set-screw type.
    - a. Do not use indenter type connectors and couplings.
    - b. Do not use set-screw type connectors and couplings.
  - 5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
  - 6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

### 2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
  - 1. Cantex Inc: www.cantexinc.com.
  - 2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com.
  - 3. JM Eagle: www.jmeagle.com.
  - 4. AFC Cable Systems, Inc.
  - 5. Electri-Flex Company.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

### 2.11 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc: www.afcweb.com.
  - 2. Electri-Flex Company: www.electriflex.com.
  - 3. International Metal Hose: www.metalhose.com.
- B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.
- C. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

### 2.12 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.
- E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

F. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

# PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify routing and termination locations of conduit prior to rough-in this includes verify location of equipment and equipment power connection points.
- E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- H. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
- I. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated and routing is not shown, determine exact routing required.
  - 3. Conceal all conduits unless specifically indicated to be exposed.
  - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
    - a. Electrical rooms.
    - b. Mechanical equipment rooms.
    - c. Within joists in areas with no ceiling.
  - 5. Unless otherwise approved, do not route conduits exposed:
    - a. Across floors.
    - b. Across roofs.
    - c. Across top of parapet walls.
    - d. Across building exterior surfaces.
    - e. Across walls (except as specifically permitted in existing construction).
  - 6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
  - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
  - 8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
  - 9. Arrange conduit to provide no more than 150 feet between pull points.
  - 10. Route conduits above water and drain piping where possible.
  - 11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  - 12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
  - 13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    - a. Heaters.
    - b. Hot water piping.

- c. Flues.
- 14. Group parallel conduits in the same area together on a common rack.
- 15. Maintain 2" minimum clearance to roof decks.
- J. Conduit Support:
  - 1. Secure and support conduits in accordance with NFPA 70 and Section 26-05-29 using suitable supports and methods approved by the authority having jurisdiction.
  - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
  - 4. Use conduit strap to support single surface-mounted conduit.
    - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
  - 5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
  - 6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
  - 7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
  - 8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
  - 9. Use of spring steel conduit clips for support of conduits is not permitted.
    - a. Support of electrical metallic tubing (EMT) up to 1 inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
  - 10. Use of wire for support of conduits is permitted only as follows:
    - a. Above suspended ceilings for suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).
- K. Connections and Terminations:
  - 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  - 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  - 3. Use suitable adapters where required to transition from one type of conduit to another.
  - 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
  - 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
  - 6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
  - 7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
  - 8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- L. Penetrations:
  - 1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
  - 2. Do not route conduits through openings in equipment cabinets or casings. Provide conduit fittings to connect to such cabinets or casings.
  - 3. Make penetrations perpendicular to surfaces unless otherwise indicated.
  - 4. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
  - 5. Conceal bends for conduit risers emerging above ground.
  - 6. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
  - 7. Provide suitable modular seal where conduits penetrate exterior wall below grade.
  - 8. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

- 9. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
- 10. Penetrate cabinets housings, and casings of equipment using conduit fittings and holes specifically for that purpose. Do nout route conduit through holes in cabinets, housings or casings.
- 11. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07-84-00.
- M. Underground Installation:
  - 1. Provide trenching and backfilling for all underground circuits required. Backfill in 8" lifts and compact to 95% compaction in unpaved areas and 98% compaction at paved areas.
  - 2. Minimum Cover, Unless Otherwise Indicated or Required:
    - a. Underground, Exterior: 24 inches.
    - b. Under Slab on Grade: 12 inches to bottom of slab.
  - 3. Provide underground warning tape in accordance with Section 26-05-53 along entire conduit length for service entrance where not concrete-encased.
- N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03-30-00 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.
- O. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.
- P. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
  - 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  - 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
  - 3. Where conduits are subject to earth movement by settlement or frost.
- Q. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
  - 1. Where conduits pass from outdoors into conditioned interior spaces.
  - 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- R. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- S. Provide grounding and bonding in accordance with Section 26-05-26.

### 3.03 FIELD QUALITY CONTROL

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- C. Correct deficiencies and replace damaged or defective conduits.

### 3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

### 3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.
- B. Route all above slab conduit parallel and perpendicular to walls.
- C. Route conduit under slab from point-to-point where feasible.
- D. Install expansion fittings every 200 linear feet and wherever structural expansion joints are crossed...

#### 3.06 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07-84-00.
- B. Provide all openings and sleeves for conduits penetrating exterior walls, interior walls and other partitions, floors and roofs. Waterproof penetrations through exterior walls. Seal all other penetrations smoke tight.
- C. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation .

#### END OF SECTION

# SECTION 26-05-37 BOXES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Boxes for hazardous (classified) locations.
- D. Floor boxes.
- E. Underground boxes/enclosures.

#### 1.02 RELATED REQUIREMENTS

- A. Section 26-05-29 Hangers and Supports for Electrical Systems.
- B. Section 26-05-34 Conduit:
  - 1. Conduit bodies and other fittings.
  - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- C. Section 26-05-53 Identification for Electrical Systems: Identification products and requirements.
- D. Section 26-27-26 Wiring Devices:
  - 1. Wall plates.
  - 2. Floor box service fittings.
  - 3. Additional requirements for locating boxes for wiring devices.

#### 1.03 REFERENCE STANDARDS

- A. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- B. NECA 130 Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association.
- C. NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association (ANSI/NEMA FB 1).
- D. NEMA OS 1 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association (ANSI/NEMA OS 1).
- E. NEMA OS 2 Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association (ANSI/NEMA OS 2).
- F. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.
- G. NFPA 70 National Electrical Code; National Fire Protection Association.
- H. SCTE 77 Specification for Underground Enclosure Integrity; Society of Cable Telecommunications Engineers (ANSI/SCTE 77).
- I. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations.
- J. UL 50E Enclosures for Electrical Equipment, Environmental Considerations.
- K. UL 508A Industrial Control Panels.
- L. UL 514A Metallic Outlet Boxes.
- M. UL 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
- N. UL 1203 Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
- 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
- 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
- 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
- 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
- 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
- 6. Coordinate the work with other trades to preserve insulation integrity.
- 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
- 8. Correlate box quantities and sizes required for the project with circuit lengths and routing. The drawings do not attempt to show all boxes that a contractor may require for the project.
- 9. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

# 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01-60-00 Product Requirements, for additional provisions.
  - 2. Keys for Lockable Enclosures: Two of each different key.

### **1.06 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- C. Products: Provide products listed and classified by Underwriters Laboratories Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

# PART 2 PRODUCTS

# 2.01 BOXES

- A. General Requirements:
  - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
  - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
  - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
  - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.

- 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
- 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
- 4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
- 5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
- 6. Use suitable concrete type boxes where flush-mounted in concrete.
- 7. Use suitable masonry type boxes where flush-mounted in masonry walls.
- 8. Use raised covers suitable for the type of wall construction and device configuration where required.
- 9. Use shallow boxes where required by the type of wall construction.
- 10. Do not use "through-wall" boxes designed for access from both sides of wall.
- 11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
- 12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
- 13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
- 14. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
- 15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
- 16. Minimum Box Size, Unless Otherwise Indicated:
  - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
  - b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
  - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
- 17. Wall Plates: Comply with Section 26-27-26.
- 18. Manufacturers:
  - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
  - b. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com.
  - c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
  - d. Thomas & Betts Corporation: www.tnb.com.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
  - 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  - 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    - a. Indoor Clean, Dry Locations: Type 1, painted steel.
    - b. Outdoor Locations: Type 3R, painted steel.
  - 3. Junction and Pull Boxes Larger Than 100 cubic inches:
    - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    - b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
  - 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    - b. Back Panels: Painted steel, removable.
    - c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
  - 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
  - 6. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
    - b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com.
    - c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com.
- D. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
  - 1. Manufacturers:
    - a. Appleton, a brand of Emerson Industrial Automation: www.emersonindustrial.com.

- b. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
- c. Hubbell Incorporated; Killark Products: www.hubbell-killark.com.
- E. Floor Boxes:
  - 1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26-27-26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
  - 2. Use cast iron floor boxes within slab on grade.
  - 3. Use sheet-steel or cast iron floor boxes within slab above grade.
  - 4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
  - 5. Manufacturer: Same as manufacturer of floor box service fittings.
- F. Underground Boxes/Enclosures:
  - 1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
  - 2. Size: as required for depth, conditions, size and quantity of conduits passing through box..
  - 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
  - 4. Applications:
    - a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 8 load rating.
    - b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 15 load rating.
    - c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
  - 5. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
    - a. Manufacturers:
      - 1) Highline Products, a subsidiary of MacLean Power Systems: www.highlineproducts.com.
      - 2) Hubbell Incorporated; Quazite Products: www.hubbellpowersystems.com.
      - 3) Oldcastle Precast, Inc: www.oldcastleprecast.com.
    - b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify locations of boxes and outlets in all areas prior to rough-in.

#### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
  - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08-31-00 as required where approved by the Architect.

- 2. Unless dimensioned, box locations indicated are approximate.
- 3. Locate boxes as required for devices installed under other sections or by others.
  - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26-27-26.
- 4. Locate boxes so that wall plates do not span different building finishes.
- 5. Locate boxes so that wall plates do not cross masonry joints.
- 6. Coordinate box locations with casework drawings and architectural wall elevations and insure that boxes are located so that covers will fit and clear cabinetry, backsplashes, mirrors, wall mounted accessories, etc.
- 7. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
- 8. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
- 9. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
- 10. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
  - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
  - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
- 11. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26-05-34.
- 12. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
  - a. Concealed above accessible suspended ceilings.
  - b. Within joists in areas with no ceiling.
  - c. Electrical rooms.
  - d. Mechanical equipment rooms.
- I. Box Supports:
  - 1. Secure and support boxes in accordance with NFPA 70 and Section 26-05-29 using suitable supports and methods approved by the authority having jurisdiction.
  - 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
  - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system. Provide separate and independent support from the structure.
  - 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
  - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
  - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Install boxes as required to preserve insulation integrity.
- M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- N. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.
- O. Underground Boxes/Enclosures:

- 1. Install enclosure on gravel base, minimum 6 inches deep.
- 2. Flush-mount enclosures located in concrete or paved areas.
- 3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
- 4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
- P. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07-84-00.
- R. Close unused box openings.
- S. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- T. Provide grounding and bonding in accordance with Section 26-05-26.
- U. Identify boxes in accordance with Section 26-05-53.
- V. Install boxes securely, in a neat and workmanlike manner and in accordance with NECA 1.
- W. Install in locations as shown on Drawings, and additionally as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70 and site conditions.
- X. Coordinate installation of outlet boxes for equipment connected under Section 26-27-17.
- Y. Size all boxes in accordance with applicable articles of NFPA 70.
- Z. Set wall mounted boxes at elevations to accommodate mounting heights as indicated on the plans or as specified in section for outlet devices.
- AA. Unless specified otherwise, rough-in boxes for the following devices as follows:
  - 1. Switch Boxes: 44" above finished floor. Boxes beside doors shall be mounted so that the edge of the trim plate is 2" from the edge of the door trim.
  - 2. Communication Boxes: 16" above finished floor except for wall phones. Wall phone boxes shall be 44" from floor.
  - 3. Fire Alarm Pull Station Boxes: 44" above finished floor (to center of box).
  - 4. Fire Alarm Signal Device Boxes: 96" above finished floor or 6" below ceiling (to top of device) for areas with ceilings lower than 86"
- AB. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
  - Adjust box locations up to 10 feet if required to accommodate intended purpose. Coordinate exact rough-in location with other items to be located in the same area such as bookshelves, cabinetry or other built-in furnishings.
- AC. Orient boxes to accommodate wiring devices oriented as specified in Section 26-27-26.
- AD. Maintain headroom and present neat mechanical appearance.
- AE. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- AF. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- AG. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods consistent with UL requirements for the element penetrated.
- AH. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- Al. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- AJ. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- AK. Use flush mounting outlet box in finished areas.
- AL. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.
- AM. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

- AN. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- AO. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- AP. Use adjustable steel channel fasteners for hung ceiling outlet box.
- AQ. Do not fasten boxes to ceiling support wires.
- AR. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
- AS. Use gang box where more than one device is mounted together. Do not use sectional box.
- AT. Use gang box with plaster ring for single device outlets.
- AU. Use cast outlet box in exterior locations and wet locations.
- AV. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- AW. Set floor boxes level.
- AX. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

### 3.03 ADJUSTING

- A. Adjust floor boxes flush with finish flooring material.
- B. Adjust flush-mounting outlets to make front flush with finished wall material. Boxes not installed flush with the finished surface must be remounted at no additional cost to this contract.
- C. Install knockout closures in unused box openings.

### 3.04 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

### 3.05 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.
- B. Clean exposed surfaces and restore finish.

# SECTION 26-05-53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

#### PART 1 GENERAL

### **1.01 SECTION INCLUDES**

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Building wire color coding.
- E. Voltage markers.
- F. Underground warning tape.
- G. Floor marking tape.
- H. Warning signs and labels.
- I. Field-painted identification of conduit.

### 1.02 REFERENCE STANDARDS

- A. ANSI Z535.2 American National Standard for Environmental and Facility Safety Signs.
- B. ANSI Z535.4 American National Standard for Product Safety Signs and Labels.
- C. NFPA 70 National Electrical Code; National Fire Protection Association.
- D. NFPA 70E Standard for Electrical Safety in the Workplace; National Fire Protection Association.
- E. UL 969 Marking and Labeling Systems.

## 1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
  - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
  - 2. Do not install identification products until final surface finishes and painting are complete.

### 1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- B. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- C. Product Data: Provide catalog data for nameplates, labels, and markers.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

### 1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

### 1.06 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

### PART 2 PRODUCTS

#### 2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
  - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

- 1) Identify ampere rating.
- 2) Identify voltage and phase.
- 3) Identify power source and circuit number. Include location.
- 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
- 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
- 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device.
- b. Enclosed switches, circuit breakers, and motor controllers:
  - 1) Identify voltage and phase.
  - 2) Identify power source and circuit number. Include location.
  - 3) Identify load(s) served. Include location.
- c. Time Switches:
  - 1) Identify load(s) served and associated circuits controlled. Include location.
- d. Enclosed Contactors:
  - 1) Identify ampere rating.
  - 2) Identify voltage and phase.
  - 3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
  - 4) Identify coil voltage.
  - 5) Identify load(s) and associated circuits controlled. Include location.
- 2. Service Equipment:
  - a. Use identification nameplate to identify each service disconnecting means.
  - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
  - c. Use identification nameplate at each piece of service equipment to identify the available fault current and the date calculations were performed.
- 3. Emergency System Equipment:
  - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
  - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
  - c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.
- 4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
- 5. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
- 6. Use identification label on inside of door at each fused switch to identify required NEMA fuse class and size.
- 7. Use identification label on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
- 8. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
- 9. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
  - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09-91-23 and 09-91-13.
- 10. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures,

and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.

- a. Minimum Size: 3.5 by 5 inches.
- b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
- 11. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.
- B. Identification for Conductors and Cables:
  - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26-05-19.
  - 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
  - 3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    - a. At each source and load connection.
    - b. Within boxes when more than one circuit is present.
    - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
    - d. In cable tray, at maximum intervals of 20 feet.
  - 4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
- C. Identification for Raceways:
  - 1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
  - 2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
    - a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      - 1) Color Code:
        - (a) Emergency Power System: Red.
        - (b) Fire Alarm System: Red.
      - 2) Field-Painting: Comply with Section 09-91-23 and 09-91-13.
      - 3) Vinyl Color Coding Electrical Tape: Comply with Section 26-05-19.
  - 3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
  - 4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
  - 5. Use underground warning tape to identify underground raceways.
- D. Identification for Boxes:
  - 1. Use voltage markers to identify highest voltage present.
  - 2. Use voltage markers or color coded boxes to identify systems other than normal power system.
    - a. Color-Coded Boxes: Field-painted in accordance with Section 09-91-23 and 09-91-13 per the same color code used for raceways.
  - Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
     a. For exposed boxes in public areas, use only identification labels.
- E. Identification for Devices:
  - 1. Wiring Device and Wallplate Finishes: Comply with Section 26-27-26.
  - 2. Factory Pre-Marked Wallplates: Comply with Section 26-27-26.
  - 3. Use identification label to identify fire alarm system devices.

- a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
- 4. Use identification label to identify serving branch circuit each receptacle.
- 5. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
- 6. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.
- F. Identification for Luminaires:
  - 1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

# 2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
  - 1. Manufacturers:
    - a. Brimar Industries, Inc: www.brimar.com.
    - b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
    - c. Seton Identification Products: www.seton.com.
  - 2. Materials:
    - a. Indoor Clean, Dry Locations: Use plastic nameplates.
    - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
  - 3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
    - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
  - 4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
  - 5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
  - 6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
  - 1. Manufacturers:
    - a. Brady Corporation: www.bradyid.com.
    - b. Brother International Corporation: www.brother-usa.com.
    - c. Panduit Corp: www.panduit.com.
  - 2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
    - a. Use only for indoor locations.
  - 3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
  - 1. Minimum Size: 1 inch by 2.5 inches.
  - 2. Legend:
    - a. System designation where applicable:
      - 1) Emergency Power System: Identify with text "EMERGENCY".
      - 2) Fire Alarm System: Identify with text "FIRE ALARM".
    - b. Equipment designation or other approved description.
    - c. Other information as indicated.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height:
    - a. System Designation: 1 inch.
    - b. Equipment Designation: 1/2 inch.
    - c. Other Information: 1/4 inch.
    - d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.

- 5. Color:
  - a. Normal Power System:
    - 1) 480Y/277 V, 3 Phase Equipment: White text on black background.
    - 2) 208Y/120 V, 3 Phase Equipment: White text on blue background.
  - b. Emergency Power System: White text on red background.
- D. Format for General Information and Operating Instructions:
  - 1. Minimum Size: 1 inch by 2.5 inches.
    - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
    - 3. Text: All capitalized unless otherwise indicated.
    - 4. Minimum Text Height: 1/4 inch.
    - 5. Color: Black text on white background unless otherwise indicated.
- E. Format for Caution and Warning Messages:
  - 1. Minimum Size: 2 inches by 4 inches.
  - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 1/2 inch.
  - 5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
  - 1. Minimum Size: 3/8 inch by 1.5 inches.
  - 2. Legend: Power source and circuit number or other designation indicated.
    - a. Include voltage and phase for other than 120 V, single phase circuits.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 3/16 inch.
  - 5. Color: Black text on clear background.
- G. Format for Control Device Identification:
  - 1. Minimum Size: 3/8 inch by 1.5 inches.
  - 2. Legend: Load controlled or other designation indicated.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 3/16 inch.
  - 5. Color: Black text on clear background.
- H. Format for Fire Alarm Device Identification:
  - 1. Minimum Size: 3/8 inch by 1.5 inches.
  - 2. Legend: Designation indicated and device zone or address.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 3/16 inch.
  - 5. Color: Red text on white background.

# 2.03 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
  1. Do not use handwritten text.
- E. Minimum Text Height: 1/8 inch.
- F. Color: Black text on white background unless otherwise indicated.
- G. Legend:
  - 1. Power and Lighting Circuits: Branch circuit or feeder number.
  - 2. Control Circuits: Control wire number indicated on shop drawings.

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#### A. Manufacturers:

- 1. Brady Corporation: www.bradyid.com.
- 2. Brimar Industries, Inc: www.brimar.com.
- 3. Seton Identification Products: www.seton.com.
- B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- C. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- D. Legend: Type of service, continuously repeated over full length of tape.
- E. Color:

#### 2.05 FLOOR MARKING TAPE

A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

### 2.06 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
  - 1. Materials:
    - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
    - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
    - 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:
  - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
    - a. Do not use labels designed to be completed using handwritten text.
  - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
  - 3. Minimum Size: 2 by 4 inches unless otherwise indicated.
- D. Description: 4 inch wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines .

# PART 3 EXECUTION

### 3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.
- B. Degrease and clean surfaces to receive nameplates and labels.

#### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
  - 1. Surface-Mounted Equipment: Enclosure front.
  - 2. Flush-Mounted Equipment: Inside of equipment door.
  - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  - 4. Elevated Equipment: Legible from the floor or working platform.
  - 5. Branch Devices: Adjacent to device.
  - 6. Interior Components: Legible from the point of access.
  - 7. Conduits: Legible from the floor.
  - 8. Boxes: Outside face of cover.
  - 9. Conductors and Cables: Legible from the point of access.

#### IDENTIFICATION FOR ELECTRICAL SYSTEMS

- 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
  - 1. Do not use adhesives on exterior surfaces except where substrate can not be penetrated.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

### 3.03 FIELD QUALITY CONTROL

- A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.
  - 1. Identify conduit using field painting.

# SECTION 26-09-10 CABINETS AND ENCLOSURES

#### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

- A. Hinged cover enclosures.
- B. Cabinets.
- C. Terminal blocks.

#### 1.02 RELATED REQUIREMENTS

A. Section 26-05-29 - Hangers and Supports for Electrical Systems.

#### 1.03 REFERENCE STANDARDS

- A. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- B. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.
- C. NEMA ICS 4 Industrial Control and Systems: Terminal Blocks; National Electrical Manufacturers Association.
- D. NFPA 70 National Electrical Code; National Fire Protection Association.

#### 1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard data for enclosures and cabinets.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- C. Cabinet Keys: Deliver to Owner in accordance with Section 01-60-00 for maintenance materials.

#### 1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

### PART 2 PRODUCTS

### 2.01 HINGED COVER ENCLOSURES

- A. Construction: NEMA 250, Type as required for location steel enclosure.
- B. Covers: Continuous hinge, held closed by flush latch operable by key.
- C. Provide interior plywood panel for mounting terminal blocks and electrical components; finish with white enamel.
- D. Enclosure Finish: Manufacturer's standard enamel.
- E. Keys: Provide two of each different key.

#### 2.02 CABINETS

- A. Boxes: Galvanized steel.
- B. Backboard: Provide 3/4 inch thick plywood backboard for mounting terminal blocks. Paint matte white.
- C. Fronts: Steel, flush type with concealed trim clamps, door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.
- D. Provide metal barriers to form separate compartments wiring of different systems and voltages.
- E. Keys: Provide two of each different key.

#### 2.03 TERMINAL BLOCKS

A. Terminal Blocks: NEMA ICS 4.

- B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- D. Provide ground bus terminal block, with each connector bonded to enclosure.

# PART 3 EXECUTION

## 3.01 INSTALLATION

- A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner under the provisions of Section 26-05-29.
- C. Install cabinet fronts plumb.

# 3.02 CLEANING

- A. Clean electrical parts to remove conductive and harmful materials.
- B. Remove dirt and debris from enclosure.
- C. Clean finishes and touch up damage.

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

#### 1.02 RELATED REQUIREMENTS

- A. Section 03-30-00 Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26-05-26 Grounding and Bonding for Electrical Systems.
- C. Section 26-05-29 Hangers and Supports for Electrical Systems.
- D. Section 26-05-53 Identification for Electrical Systems: Identification products and requirements.
- E. Section 26-43-00 Surge Protective Devices.

### 1.03 REFERENCE STANDARDS

- A. FS W-C-375 Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification.
- B. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- C. NECA 407 Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association.
- D. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. NEMA AB 1 Molded Case Circuit Breakers.
- F. NEMA ICS 2 Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; National Electrical Manufacturers Association.
- G. NEMA PB 1 Panelboards; National Electrical Manufacturers Association.
- H. NEMA PB 1.1 General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association (ANSI/NEMA PB 1.1).
- I. NETA ATS Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association (ANSI/NETA ATS).
- J. NFPA 70 National Electrical Code; National Fire Protection Association.
- K. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations.
- L. UL 50E Enclosures for Electrical Equipment, Environmental Considerations.
- M. UL 67 Panelboards.
- N. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
- O. UL 869A Reference Standard for Service Equipment.
- P. UL 943 Ground-Fault Circuit-Interrupters.
- Q. UL 1053 Ground-Fault Sensing and Relaying Equipment.
- R. UL 1699 Arc-Fault Circuit-Interrupters.

## 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

- 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
- 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
- 5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include wiring diagrams showing all factory and field connections.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Panelboard Keys: Two of each different key.

### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

### 1.08 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
  - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
  - 2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

# PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Eaton Corporation: www.eaton.com.
- B. General Electric Company: www.geindustrial.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. Siemens Industry, Inc: www.usa.siemens.com.
- E. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

#### 2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
  - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
  - 2. Listed series ratings are not acceptable. Panelboards and breakers shall meet short circuit requirements without depending on upstream breaker characteristics.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. All busses shall be copper.
  - 2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 3. Provide 200 percent rated neutral bus and lugs where oversized neutral conductors are provided or where panelboards are fed from K-rated transformers.
  - 4. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  - 5. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  - 2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
    - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
  - 3. Fronts:

4.

- a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
- b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
- c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
- Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26-43-00, list and label panelboards as a complete assembly including surge protective device.
- L. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
  - 1. Ampere Rating: Not less than ampere rating of panelboard bus.
  - 2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
  - 3. Coil Voltage: As required for connection to control system indicated.

- M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
  - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
  - 2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
    - a. Use zero sequence ground fault detection method unless otherwise indicated.
    - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
- N. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- O. Load centers are not acceptable.
- P. Provide the following features and accessories where indicated or where required to complete installation:
  - 1. Feed-through lugs.
  - 2. Sub-feed lugs.
  - 3. Lock-on hardware.
  - 4. Lock-out hardware.
- Q. Provide the following rated breakers for the type of circuits:
  - 1. Type SWD for fluorescent lighting circuits.
  - 2. Type HACR for air conditioning equipment circuits.
  - 3. For breakers serving HID lighting circuits, provide circuit breakers UL listed as Type HID.

### 2.03 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
  - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  - 1. Phase and Neutral Bus Material: Copper.
  - 2. Ground Bus Material: Copper.
- D. Circuit Breakers:
  - 1. Provide bolt-on type.
  - 2. Provide thermal magnetic circuit breakers unless otherwise indicated.
  - 3. Provide electronic trip circuit breakers for circuit breaker frame sizes 100 amperes and above.
- E. Enclosures:
  - 1. Provide flush-mounted enclosures unless otherwise indicated.
  - 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  - 3. Provide clear plastic circuit directory holder mounted on inside of door.
- F. Minimum integrated short circuit rating: As indicated.
- G. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed.
- H. Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower, with bimetal overload relay.
- I. Enclosure: NEMA PB 1, Type as indicated in the schedule on the plans.
- J. Service Entrance labelled where used for service entrance purposes.
- K. Cabinet Front: Surface type, fastened with concealed trim clamps, hinged door with flush lock, metal directory frame, finished in manufacturer's standard gray enamel.

#### 2.04 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
  - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
  - 2. Phase and Neutral Bus Material: Copper.
  - 3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
  - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
  - 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  - 3. Provide clear plastic circuit directory holder mounted on inside of door.
- F. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- G. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.
- H. Minimum Integrated Short Circuit Rating: As indicated.
- I. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
  - 1. Type SWD for lighting circuits.
  - 2. Type HACR for air conditioning equipment circuits.
  - 3. Do not use tandem circuit breakers.
- J. Current Limiting Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole; UL listed. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.
- K. Enclosure: NEMA PB 1, type as indicated in the schedule on the plans.
- L. Service Entrance labelled where used for service entrance purposes.
- M. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.
- N. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

### 2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
  - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
  - 2. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      - 2) 14,000 rms symmetrical amperes at 480 VAC.
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
  - 3. Conductor Terminations:

6.

- a. Provide mechanical lugs unless otherwise indicated.
- b. Lug Material: Copper, suitable for terminating copper conductors only.
- 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
  - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
  - b. Provide interchangeable trip units where indicated.
- 5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
  - a. Provide the following field-adjustable trip response settings:
    - 1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
    - 2) Long time delay.
    - 3) Short time pickup and delay.
    - 4) Instantaneous pickup.
    - 5) Ground fault pickup and delay where ground fault protection is indicated.
  - Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
- 7. Provide the following circuit breaker types where indicated:
  - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
  - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
  - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
  - d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
  - e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
- 8. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
- 9. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
- 10. Do not use tandem circuit breakers.
- 11. Do not use handle ties in lieu of multi-pole circuit breakers.
- 12. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
- 13. Provide the following features and accessories where indicated or where required to complete installation:
  - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
  - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
  - c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

### 2.06 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.
- B. Minimum Integrated Short Circuit Rating: as indicated on the plans.
- C. Service Entrance labelled where used for service entrance purposes.
- D. Box: Flush or surface type as indicated on the plans, with door, and pull ring and latch on door. Finish in manufacturer's standard gray enamel.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26-05-29.
- E. Install panelboards plumb.
- F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- H. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03-30-00.
- I. Provide minimum of three spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 26-05-26.
  - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
  - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- K. Install all field-installed branch devices, components, and accessories.
- L. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- N. Set field-adjustable circuit breaker tripping function settings as indicated.
- O. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- P. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.
- Q. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- R. Install only one solid wire per screw or lug. Provide approved lug connector for securing stranded wire.
- S. Prior to energizing panelboards, check the following items for each panelboard and the associated components. Do not proceed to energize panelboards until these items have been checked and corrected as necessary.
  - 1. Check for tightness of each connection.
  - 2. Check for proper phase routing of all wiring.
  - 3. Insure that all ventilating louvers and passages are clear of obstructions.
  - 4. Check all conductors for continuity of insulation and the absence of unintended shorts or grounds.
  - 5. Remove all tools, foreign materials, construction debris, etc..
  - 6. Remove all shipping braces, packing, tape, etc..
- T. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- U. Provide filler plates to cover unused spaces in panelboards.
- V. Provide circuit breaker lock-off devices when the breaker is used as the disconnecting means for motors or other equipment.
- W. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:

- 1. Emergency and night lighting circuits.
- 2. Fire detection and alarm circuits.
- 3. Communications equipment circuits.
- 4. Intrusion detection and access control system circuits.
- X. Identify panelboards in accordance with Section 26-05-53.
- Y. Provide machine printed circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces. For distribution panels without a door, provide an engraved nameplate for each breaker to identify it's load. Revise panel directories as required to reflect all field circuiting changes as well as all room name and/or numbers if they differ from the project plans.
- Z. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- AA. Provide identification nameplate for each panelboard in accordance with Section 26-05-53.
- AB. Provide arc flash hazard warning labels in accordance with NFPA 70.
- AC. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
  - 1. Minimum spare conduits: 3 empty 3/4 inch.
- AD. Ground and bond panelboard enclosure according to Section 26-05-26.

### 3.03 FIELD QUALITY CONTROL

- A. See Section 01-40-00 Quality Requirements, for additional requirements.
- B. Perform field inspection and testing in accordance with Section 01-40-00.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers larger than 800 amperes. Tests listed as optional are not required.
- E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- F. Test GFCI circuit breakers to verify proper operation.
- G. Test AFCI circuit breakers to verify proper operation.
- H. Test shunt trips to verify proper operation.
- I. Correct deficiencies and replace damaged or defective panelboards or associated components.
- J. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

# 3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

### 3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

# SECTION 26-27-17 EQUIPMENT WIRING

#### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Electrical connections to equipment.

#### 1.02 RELATED REQUIREMENTS

- A. Section 26-05-19 Low-Voltage Electrical Power Conductors and Cables.
- B. Section 26-05-34 Conduit.
- C. Section 26-05-37 Boxes.
- D. Section 26-27-26 Wiring Devices.

#### 1.03 REFERENCE STANDARDS

- A. NEMA WD 1 General Color Requirements for Wiring Devices; National Electrical Manufacturers Association.
- B. NEMA WD 6 Wiring Devices Dimensional Requirements; National Electrical Manufacturers Association.
- C. NFPA 70 National Electrical Code; National Fire Protection Association.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
  - 2. Determine connection locations and requirements.
- B. Sequencing:
  - 1. Install rough-in of electrical connections before installation of equipment is required.
  - 2. Make electrical connections before required start-up of equipment.

#### 1.05 SUBMITTALS

- A. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

## PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
  - 1. Colors: Conform to NEMA WD 1.
  - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
  - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Disconnect Switches: As specified in this division. .
- C. Wiring Devices: As specified in Section 26-27-26.
- D. Flexible Conduit: As specified in Section 26-05-34.
- E. Wire and Cable: As specified in Section 26-05-19.
- F. Boxes: As specified in Section 26-05-37.

#### 2.02 EQUIPMENT CONNECTIONS

- A. Provide power connections to each piece of equipment that is supplied by any contractor or subcontractor or Owner on this project. Provide power connection to a single point on the equipment. The contractor installing the equipment will be responsible for any additional wiring connections and all control wiring unless noted otherwise on the plans.
  - 1. Electrical Connection: Flexible conduit.
    - a. Use liquid tight flexible conduit for outdoor equipment or equipment exposed to water spray.
    - b. Use liquid tight flexible conduit for connections to all TEFC motors and equipment suitable for use in a damp or wet environment.
  - 2. Provide field-installed disconnect switch where shown or required.
  - 3. Verify the voltage, amperage and overcurrent protection required for each piece of equipment prior to making connections.
  - 4. Provide conduit fittings for the type of conduit used to pentrate equipment housings, cases, and cabinets. Provide holes of the proper size in approved locations.
    - a. Do not pass conduits through equipment housings, cases or cabinets withouth the use of connection fittings.

# PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

#### 3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Cut holes in designated areas of cabinets or enclosures of equipment if required for connetion power to unit. Provide conduit fittings at cabinet or enclosure penetration. Do not route conduits through factory or field cut openings in equipment cabinets or enclosures.
- D. Route conduits underground and rise to equipment when connection points are more than 2' from a building, fence or structure. Do not route conduits across equipment courtyards, equipment pads, or similar areas where the conduit could become a tripping hazard. Coordinate to rough-in underground conduits before equipment pads are poured.
- E. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- F. Provide receptacle outlet to accommodate connection with attachment plug.
- G. Provide cord and cap where field-supplied attachment plug is required.
- H. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- I. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- J. Install terminal block jumpers to complete equipment wiring requirements.
- K. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- L. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

# SECTION 26-27-26 WIRING DEVICES

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Fan speed controllers.
- D. Receptacles.
- E. Wall plates.
- F. Floor box service fittings.
- G. Poke-through assemblies.
- H. Access floor boxes.

### 1.02 RELATED REQUIREMENTS

- A. Section 09-69-00 Access Flooring.
- B. Section 26-05-19 Low-Voltage Electrical Power Conductors and Cables : Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors .
- C. Section 26-05-37 Boxes.
- D. Section 26-05-53 Identification for Electrical Systems: Identification products and requirements.

### 1.03 REFERENCE STANDARDS

- A. FS W-C-596 Connector, Electrical, Power, General Specification for; Federal Specification.
- B. FS W-S-896 Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification.
- C. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- D. NEMA WD 1 General Color Requirements for Wiring Devices; National Electrical Manufacturers Association.
- E. NEMA WD 6 Wiring Device -- Dimensional Specifications; National Electrical Manufacturers Association.
- F. NFPA 70 National Electrical Code; National Fire Protection Association.
- G. UL 20 General-Use Snap Switches.
- H. UL 498 Attachment Plugs and Receptacles.
- I. UL 514D Cover Plates for Flush-Mounted Wiring Devices.
- J. UL 943 Ground-Fault Circuit-Interrupters.
- K. UL 1472 Solid-State Dimming Controls.
- L. UL 1917 Solid-State Fan Speed Controls.

### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
  - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
  - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
  - 5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.

6. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

### B. Sequencing:

- 1. Do not install wiring devices until final surface finishes are complete.
- 2. Protect devices from painting and remove all paint that is applied to devices in the field.

### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
  - 1. Wall Dimmers: Include derating information for ganged multiple devices.
  - 2. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.
- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- C. Operation and Maintenance Data:
  - 1. Wall Dimmers: Include information on operation and setting of presets.
  - 2. GFCI Receptacles: Include information on status indicators.
  - 3. Surge Protection Receptacles: Include information on status indicators.
- D. Project Record Documents: Record actual installed locations of wiring devices.

### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed, classified, and labeled as suitable for the purpose intended.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### 1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

### PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Hubbell Incorporated; : www.hubbell-wiring.com.
- B. Leviton Manufacturing Company, Inc; : www.leviton.com.
- C. Lutron Electronics Company, Inc: www.lutron.com.
- D. Pass & Seymour, a brand of Legrand North America, Inc; : www.legrand.us
- E. B-Line Systems, Inc.
- F. GE Wiring Devices.
- G. Source Limitations: Where possible, provide products for each type of wiring device produced by a single manufacturer and obtained from a single supplier.
- H. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer.

### 2.02 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles for receptacles installed in dwelling units.

- E. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- F. Provide GFCI protection for receptacles installed in kitchens.
- G. Provide GFCI protection for receptacles serving electric drinking fountains.
- H. Provide isolated ground receptacles for receptacles serving computers and electronic cash registers.
- I. Unless noted otherwise, do not use combination switch/receptacle devices.
- J. For flush floor service fittings, use tile rings for installations in tile floors.
- K. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

### 2.03 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: Gray with white stainless steel wall plate.
- C. Wiring Devices Installed in Finished Spaces: Gray with stainless steel wall plate.
- D. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
- E. Wiring Devices Installed in Wet or Damp Locations: Gray with specified weatherproof cover.
- F. Isolated Ground Convenience Receptacles: Orange.
- G. Surge Protection Receptacles: Blue.
- H. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.
- I. Clock Hanger Receptacles: Brown with stainless steel wall plate.
- J. Above-Floor Service Fittings: Gray wiring devices with satin aluminum housing.
- K. Flush Floor Box Service Fittings: Gray wiring devices with aluminum cover and ring/flange.
- L. Flush Poke-Through Service Fittings: Gray wiring devices with aluminum cover and aluminum flange.
- M. Access Floor Boxes: Gray wiring devices with gray steel cover with insert to match floor covering.

# 2.04 WALL SWITCHES

- A. Manufacturers:
  - 1. Hubbell Incorporated; : www.hubbell-wiring.com.
  - 2. Leviton Manufacturing Company, Inc; : www.leviton.com.
  - 3. Pass & Seymour, a brand of Legrand North America, Inc; : www.legrand.us
- B. Wall Switches General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- D. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- E. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

### 2.05 WALL DIMMERS

- A. Manufacturers:
  - 1. Leviton Manufacturing Company, Inc: www.leviton.com.
  - 2. Lutron Electronics Company, Inc: www.lutron.com.
  - 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

- B. Wall Dimmers General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- C. Control: Slide control type with separate on/off switch.
- D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings: Incandescent: 600 W. 1.
  - Magnetic Low-Voltage: 600 VA. 2.
  - Electronic Low-Voltage: 400 VA. 3.
  - 4. Fluorescent: 600 VA.
- E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

### 2.06 FAN SPEED CONTROLLERS

- Α. Manufacturers:
  - Leviton Manufacturing Company, Inc: www.leviton.com. 1.
  - 2. Lutron Electronics Company, Inc: www.lutron.com.
  - Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us 3.
- Description: 120 V AC, solid-state, full-range variable speed, slide control type with separate on/off B. switch, with integral radio frequency interference filtering, fan noise elimination circuitry, power failure preset memory, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1917.
  - Current Rating: 1.5 A unless otherwise indicated or required to control the load indicated on the 1. drawings.

### 2.07 RECEPTACLES

- Α. Manufacturers:
  - Hubbell Incorporated: www.hubbell-wiring.com. 1.
  - 2. Leviton Manufacturing Company, Inc: www.leviton.com.
  - 3 Lutron Electronics Company, Inc: www.lutron.com.
  - Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us 4.
  - Source Limitations: Where wall controls are furnished as part of lighting control system, provide 5. accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- Β. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring with separate ground terminal screw.
  - 2. NEMA configurations specified are according to NEMA WD 6.
  - Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot 3. hospital grade mark on device face.
- Convenience Receptacles: C.
  - Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; 1. single or duplex as indicated on the drawings.
  - 2. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
  - Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 3. 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
  - 4. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
  - Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification 5. grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

- D. GFCI Receptacles:
  - 1. GFCI Receptacles General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
  - 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
  - Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
  - 4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
  - 5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
- E. Clock Hanger Receptacles: Single, 15A, 125V, NEMA 5-15R.

# 2.08 WALL PLATES

- A. Manufacturers:
  - 1. Hubbell Incorporated: www.hubbell-wiring.com.
  - 2. Leviton Manufacturing Company, Inc: www.leviton.com.
  - 3. Lutron Electronics Company, Inc: www.lutron.com.
  - 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
  - 5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Wall Plates: Comply with UL 514D.
  - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
  - 2. Size: Oversized; Stainless Steel.
  - 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- E. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- F. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

### 2.09 FLOOR BOX SERVICE FITTINGS

- A. Manufacturers:
  - 1. Hubbell Incorporated: www.hubbell-wiring.com.
  - 2. Thomas & Betts Corporation: www.tnb.com.
  - 3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us
- B. Description: Service fittings compatible with floor boxes provided under Section 26-05-37 with components, adapters, and trims required for complete installation.
- C. Above-Floor Service Fittings:
  - 1. Single Service Pedestal Convenience Receptacles:
    - a. Configuration: One standard convenience duplex receptacle.
  - 2. Single Service Pedestal Communications Outlets:
    - a. Configuration: One 1 inch bushed opening.
      - b. Voice and Data Jacks: Provided by others.
  - 3. Single Service Pedestal Furniture Feed:
  - a. Configuration: One 3/4 inch knockout.
  - 4. Dual Service Pedestal Combination Outlets:
    - a. Configuration:

1.

4.

- Power: One standard convenience duplex receptacle. 1)
- 2) Communications: One 1 inch bushed opening.
- Voice and Data Jacks: Provided by others. 3)
- b. Provide barrier to separate line and low voltage compartments.
- D. Flush Floor Service Fittings:
  - Single Service Flush Convenience Receptacles:
  - a. Cover: Rectangular.
  - b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
  - 2. Single Service Flush Furniture Feed:
    - a. Cover: Rectangular.
    - b. Configuration: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
  - 3. **Dual Service Flush Combination Outlets:** 
    - a. Cover: Rectangular.
    - b. Configuration:
      - 1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).
      - Voice and Data Jacks: Provided by others. 2)
    - **Dual Service Flush Furniture Feed:**
    - a. Cover: Rectangular.
    - b. Configuration:
      - 1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
      - Communications: One 2-1/8 inch by 1 inch combination threaded opening(s). 2)
  - 5. Accessories:
    - Tile Rings: Finish to match covers; configuration as required to accommodate specified a. covers.
    - Carpet Flanges: Finish to match covers; configuration as required to accommodate specified h covers.

### 2.10 POKE-THROUGH ASSEMBLIES

- Α. Manufacturers:
  - Hubbell Incorporated: www.hubbell-wiring.com. 1.
  - Thomas & Betts Corporation: www.tnb.com. 2.
  - 3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us
- Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke B. barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.
- C. Above-Floor Service Fittings:
  - Single Service Pedestal Convenience Receptacles: 1.
  - Configuration: One standard convenience duplex receptacle. a. 2.
    - Single Service Pedestal Communications Outlets:
      - a. Configuration: One 1 inch bushed opening.
      - b. Voice and Data Jacks: Provided by others.
  - 3. Single Service Pedestal Furniture Feed:
    - a. Configuration: One 3/4 inch knockout.
  - 4. **Dual Service Pedestal Combination Outlets:** 
    - Configuration: a.
      - 1) Power: One standard convenience duplex receptacle.
      - 2) Communications: One 1 inch bushed opening.
      - Voice and Data Jacks: Provided by others. 3)
    - b. Provide barrier to separate line and low voltage compartments.
- D. Flush Floor Service Fittings:
  - Single Service Flush Convenience Receptacles: 1.
    - a. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
  - 2. Single Service Flush Communications Outlets:
    - a. Configuration: \_\_\_\_\_.

3.

- b. Voice and Data Jacks: Provided by others.
- Single Service Flush Furniture Feed:
  - a. Configuration: One 2 inch by 1-1/4 inch combination threaded opening(s).
- 4. Dual Service Flush Combination Outlets:
  - a. Cover: Hinged door(s).
  - b. Configuration:
    - 1) Power: One standard convenience duplex receptacle(s).
    - 2) Communications: \_\_\_\_
    - 3) Voice and Data Jacks: Provided by others.
- 5. Dual Service Flush Furniture Feed:
  - a. Configuration:
    - 1) Power: One 3/4 inch threaded opening(s).
    - 2) Communications: Two 1/2 inch threaded opening(s).
- 6. Accessories:
  - a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

### 2.11 ACCESS FLOOR BOXES

- A. Manufacturers Access Floor Boxes:
  - 1. Hubbell Incorporated: www.hubbell-wiring.com.
  - 2. Thomas & Betts Corporation: www.tnb.com.
  - 3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us
  - 4. Appleton Electric Company.
- B. Manufacturers Access Floor Boxes with Pre-wired Connectors for Manufactured Wiring Systems:
  - 1. AFC Cable Systems Inc: www.afcweb.com.
  - 2. RELOC Wiring Solutions, a brand of Acuity Brands, Inc: www.relocwiring.com.
  - 3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us.
  - 4. Source Limitations: Provide access floor boxes with pre-wired connectors produced by the same manufacturer as the manufactured wiring system used for this project.
- C. Description: Metallic multi-service box suitable for mounting in access floor system specified in Section 09-69-00.
- D. Access floor boxes with pre-wired connectors for manufactured wiring systems are permitted only where manufactured wiring systems are permitted as specified in Section 26-05-19.
- E. Configuration:
  - 1. Power: Two standard convenience duplex receptacle(s).
  - 2. Communications: if applicable.
  - 3. Voice and Data Jacks: Provided by others.

# PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete.
- E. Verify that floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that core drilled holes for poke-through assemblies are in proper locations.
- H. Verify that openings in access floor are in proper locations.
- I. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### 3.03 INSTALLATION

2.

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26-05-37 as required for installation of wiring devices provided under this section.
  - 1. Mounting Heights (to bottom of device): Unless otherwise indicated, as follows:
    - a. Wall Switches: 44 above finished floor.
    - b. Wall Dimmers: 44 above finished floor.
    - c. Fan Speed Controllers: 44 above finished floor.
    - d. Receptacles: 16 above finished floor or 2" above counter backsplash.
    - Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
  - 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
  - 4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Engineer to obtain direction prior to proceeding with work.
  - 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install device boxes flush with surface of the wall. The box (or mud ring where applicable) may be no more than 1/8" recessed in the wall opening. Provide extension rings as required to correct all boxes that are not flush with the wall.
- D. Install wiring devices in accordance with manufacturer's instructions.
- E. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- F. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- G. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Do not use push-in pressure binding terminals to connect conductors to devices.
- H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- I. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.
- J. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices unless specifically noted on the plan.
- K. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
- L. Install wiring devices plumb and level with mounting yoke held rigidly in place. Adjust all devices that are found to be out of plumb or "soft" in wall.
- M. Install wall switches with OFF position down.
- N. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- O. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- P. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

- Q. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings.
- R. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- S. Identify wiring devices in accordance with Section 26-05-53.
- T. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.
- U. Coordinate locations of outlet boxes to obtain mounting heights specified or indicated on plans.

### 3.04 FIELD QUALITY CONTROL

- A. See Section 01-40-00 Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Inspect each surge protection receptacle to verify surge protection is active.
- G. Correct wiring deficiencies and replace damaged or defective wiring devices.
- H. Check for tight and secure and mounting. Repair any loose or "soft" devices that move or deflect when a plug is inserted or removed.

### 3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Align plates plumb and level with adjacent surfaces.

### 3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

# SECTION 26-28-13 FUSES

### PART 1 GENERAL

### **1.01 SECTION INCLUDES**

A. Fuses.

### 1.02 RELATED REQUIREMENTS

A. Section 26-28-18 - Enclosed Switches: Fusible switches.

#### 1.03 REFERENCE STANDARDS

- A. NEMA FU 1 Low Voltage Cartridge Fuses; National Electrical Manufacturers Association.
- B. NFPA 70 National Electrical Code; National Fire Protection Association.
- C. UL 248-1 Low-Voltage Fuses Part 1: General Requirements.
- D. UL 248-4 Low-Voltage Fuses Part 4: Class CC Fuses.
- E. UL 248-10 Low-Voltage Fuses Part 10: Class L Fuses.
- F. UL 248-12 Low-Voltage Fuses Part 12: Class R Fuses.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
    - a. Fusible Enclosed Switches: See Section 26-28-18.
    - b. Fusible Switches for Enclosed Motor Controllers: See Section 26-29-13.
  - Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
  - 3. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three yearsdocumented experience and with service facilities within 100 miles of Project..
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- D. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

### PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com.
- B. Cutler-Hammer.
- C. GE Company.
- D. Littelfuse, Inc: www.littelfuse.com.

#### 2.02 APPLICATIONS

- A. Service Entrance:
  - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

- B. Feeders:
  - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- C. General Purpose Branch Circuits: Class RK1, time-delay.
- D. Individual Motor Branch Circuits: Class RK1, time-delay.
- E. Primary Protection for Control Transformers: Class CC, time-delay.

# 2.03 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
- H. Class L Fuses: Comply with UL 248-10.
- I. Class CC Fuses: Comply with UL 248-4.
- J. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- K. Provide the following accessories where indicated or where required to complete installation:
  - 1. Fuseholders: Compatible with indicated fuses.
  - 2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.
- L. Main Service Switches Larger than 600 amperes: Class L (time delay) current limiting with 200,000 amp interrupting rating..
- M. Power Load Feeder Switches Larger than 600 amperes: Class L (fast-acting), current limiting with 200,000 amp interrupting rating.
- N. Power Load Feeder Switches 600A and less: Class J (non-time-delay), current limiting with 200,000 amp interrupting rating.
- O. Motor Load Feeder Switches: Class RK1 (time delay), current limiting with 200,000 amp interrupting rating.
- P. Other Feeder Switches: Class RK1 (time delay).
- Q. General Purpose Branch Circuits: Class RK5.
- R. Motor Branch Circuits: Class L time delay.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

# 3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.
## SECTION 26-28-18 ENCLOSED SWITCHES

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

A. Enclosed safety switches.

#### 1.02 RELATED REQUIREMENTS

- A. Section 26-05-26 Grounding and Bonding for Electrical Systems.
- B. Section 26-05-29 Hangers and Supports for Electrical Systems.
- C. Section 26-05-53 Identification for Electrical Systems: Identification products and requirements.
- D. Section 26-28-13 Fuses.

#### 1.03 REFERENCE STANDARDS

- A. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- B. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.
- C. NEMA KS 1 Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); National Electrical Manufacturers Association.
- D. NETA ATS Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association (ANSI/NETA ATS).
- E. NFPA 70 National Electrical Code; National Fire Protection Association.
- F. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations.
- G. UL 50E Enclosures for Electrical Equipment, Environmental Considerations.
- H. UL 98 Enclosed and Dead-Front Switches.
- I. UL 869A Reference Standard for Service Equipment.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 4. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include wiring diagrams showing all factory and field connections.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- D. Project Record Documents: Record actual locations of enclosed switches.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

## 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

### 1.08 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

### PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Eaton Corporation: www.eaton.com.
- B. General Electric Company: www.geindustrial.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. Siemens Industry, Inc: www.usa.siemens.com.
- E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

### 2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
  - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not lower than the panel SCCR rating from which the circuit originates..
  - 2. Minimum Ratings:
    - a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
    - b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
    - c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
- G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- H. Provide with switch blade contact position that is visible when the cover is open.

- I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
  - 1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- J. Conductor Terminations: Suitable for use with the conductors to be installed.
- K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- M. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- O. Heavy Duty Switches:
  - 1. Comply with NEMA KS 1.
  - 2. Conductor Terminations:
    - a. Provide mechanical lugs unless otherwise indicated.
    - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
- P. Provide the following features and accessories where indicated or where required to complete installation:
  - 1. Hubs: As required for environment type; sized to accept conduits to be installed.
  - 2. Integral fuse pullers.
  - 3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

- A. Install enclosed switches in accordance with manufacturer's instructions.
- B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26-05-29.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26-05-26.
- H. Provide fuses complying with Section 26-28-13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- J. Identify enclosed switches in accordance with Section 26-05-53.

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1. Provide engraved plastic nameplates for identifying switches.

### 3.03 FIELD QUALITY CONTROL

- A. See Section 01-40-00 Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

## 3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

### 3.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

### PART 1 GENERAL

#### **1.01 SECTION INCLUDES**

A. Surge protective devices for service entrance locations.

#### 1.02 RELATED REQUIREMENTS

A. Section 26-05-26 - Grounding and Bonding for Electrical Systems.

#### 1.03 REFERENCE STANDARDS

- A. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- B. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.
- C. NETA ATS Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association (ANSI/NETA ATS).
- D. NFPA 70 National Electrical Code; National Fire Protection Association.
- E. UL 1283 Standard for Electromagnetic Interference Filters.
- F. UL 1449 Standard for Surge Protective Devices.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to ordering equipment.

#### 1.05 SUBMITTALS

- A. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
  SPDs with EMI/RFI filter: Include noise attenuation performance.
- B. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.
- C. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
  - 1. UL 1449.
  - 2. UL 1283 (for Type 2 SPDs).
- D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
- F. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- G. Project Record Documents: Record actual connections and locations of surge protective devices.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

#### 1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### 1.09 WARRANTY

- A. See Section 01-78-00 Closeout Submittals, for additional warranty requirements.
- B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.
- C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

#### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Field-installed, Externally Mounted Surge Protective Devices:
  - 1. Advanced Protection Technologies, Inc (APT): www.aptsurge.com.
  - 2. Current Technology; a brand of Thomas & Betts Power Solutions: www.tnbpowersolutions.com.
  - 3. General Electric Company: www.geindustrial.com.
  - 4. Schneider Electric; Square D Brand Surgelogic Products: www.surgelogic.com.
- B. Factory-installed, Internally Mounted Surge Protective Devices:
  - 1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

## 2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.
- B. Protected Modes:
  - 1. Wye Systems: L-N, L-G, N-G, L-L.
  - 2. Delta Systems: L-G, L-L.
  - 3. Single Split Phase Systems: L-N, L-G, N-G, L-L.
- C. UL 1449 Voltage Protection Ratings (VPRs):
  - 1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
  - 2. 240/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
  - 3. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.
- D. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- E. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- F. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

#### 2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

- A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.
- B. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.
- D. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
- E. Repetitive Surge Current Capacity: Not less than 5,000 impulses.
- F. UL 1449 Nominal Discharge Current (I-n): 20 kA.

- G. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
- H. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
- I. Diagnostics:
  - 1. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
  - 2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
  - 3. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.
- J. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of the drawings and manufacturer's instructions.
- D. Verify system grounding and bonding is in accordance with Section 26-05-26, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- E. Verify that conditions are satisfactory for installation prior to starting work.

## 3.02 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1.
- B. Install SPD in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.
- E. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.
- F. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26-05-26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.
- G. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

## 3.03 FIELD QUALITY CONTROL

- A. See Section 01-40-00 Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.

### 3.04 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

# SECTION 26-51-00 INTERIOR LIGHTING

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts and drivers.
- E. Fluorescent emergency power supply units.
- F. Lamps.
- G. Luminaire accessories.

### 1.02 RELATED REQUIREMENTS

- A. Section 26-05-37 Boxes.
- B. Section 26-05-53 Identification for Electrical Systems: Identification products and requirements.

### 1.03 REFERENCE STANDARDS

- A. 47 CFR 15 Radio Frequency Devices; Code of Federal Regulations.
- B. ANSI C82.11 American National Standard for Lamp Ballasts High Frequency Fluorescent Lamp Ballasts Supplements.
- C. IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; Institute of Electrical and Electronic Engineers.
- D. IES LM-79 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society.
- E. IES LM-80 Approved Method: Measuring Lumen Maintenance of LED Light Sources; Illuminating Engineering Society.
- F. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- G. NECA/IESNA 500 Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association.
- H. NECA/IESNA 502 Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association.
- I. NEMA LE 4 Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association.
- J. NFPA 70 National Electrical Code; National Fire Protection Association.
- K. NFPA 101 Life Safety Code; National Fire Protection Association.
- L. UL 924 Emergency Lighting and Power Equipment.
- M. UL 935 Fluorescent-Lamp Ballasts.
- N. UL 1598 Luminaires.
- O. UL 8750 Light Emitting Diode (LED) Equipment for Use in Lighting Products.

### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

- 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
- 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
- 4. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

## 1.05 SUBMITTALS

- A. Shop Drawings:
  - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
  - 1. LED Luminaires:
    - a. Include estimated useful life, calculated based on IES LM-80 test data.
    - b. Include IES LM-79 test report upon request.
  - 2. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
  - 3. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
  - 4. Fluorescent Emergency Power Supply Unit: Include list of compatible lamp configurations and associated lumen output.
- C. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.
- D. Field Quality Control Reports.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- G. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

## 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 70 and NFPA 101.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### 1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

## 1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

## 1.09 WARRANTY

- A. Provide five year manufacturer warranty for all LED luminaires, including drivers.
- B. Provide two year manufacturer warranty for all linear fluorescent ballasts.

- C. Provide five year pro-rata warranty for batteries for emergency lighting units.
- D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.
- E. Provide three year full warranty for fluorescent emergency power supply units.
- F. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

### PART 2 PRODUCTS

## 2.01 MANUFACTURERS - LUMINAIRES

- A. Acuity Brands, Inc: www.acuitybrands.com.
- B. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.
- C. Hubbell Lighting, Inc: www.hubbelllighting.com.

### 2.02 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

### 2.03 LUMINAIRES

- A. Manufacturers:
  - 1. Acuity Brands, Inc: www.acuitybrands.com.
  - 2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.
  - 3. Hubbell Lighting, Inc: www.hubbelllighting.com.
- B. Provide products that comply with requirements of NFPA 70.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- F. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- G. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- H. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- I. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- J. Fluorescent Luminaires:
  - 1. Provide ballast disconnecting means complying with NFPA 70 where required.
  - 2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start ballasts.
  - 3. Fluorescent Luminaires Controlled by Dual-Level Switching: Provide with two ballasts.
    - a. Luminaires with Two Lamps: Each ballast controls one lamp.
    - b. Luminaires with Three Lamps: One ballast controls two outer lamps and one ballast controls inner lamp.
    - c. Luminaires with Four Lamps: One ballast controls two outer lamps and one ballast controls two inner lamps.
    - d. Stepped dimming ballasts may be substituted for dual ballast configurations.
- K. LED Luminaires:
  - 1. Components: UL 8750 recognized or listed as applicable.
  - 2. Tested in accordance with IES LM-79 and IES LM-80.
  - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

L. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

## 2.04 EMERGENCY LIGHTING UNITS

- A. Manufacturers:
  - 1. Acuity Brands, Inc: www.acuitybrands.com.
  - 2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.
  - 3. Hubbell Lighting, Inc: www.hubbelllighting.com.
- B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- D. Battery:
  - 1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- F. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- H. Accessories:
  - 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
  - 2. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

### 2.05 EXIT SIGNS

- A. Manufacturers:
  - 1. Acuity Brands, Inc: www.acuitybrands.com.
  - 2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.
  - 3. Hubbell Lighting, Inc: www.hubbelllighting.com.
- B. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
  - 1. Number of Faces: Single or double as indicated or as required for the installed location.
  - 2. Directional Arrows: As indicated or as required for the installed location.
- C. Self-Powered Exit Signs:
  - 1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
  - 2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
  - 3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
  - 4. Provide low-voltage disconnect to prevent battery damage from deep discharge.
  - 5. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

#### 2.06 BALLASTS AND DRIVERS

- A. Manufacturers:
  - 1. General Electric Company/GE Lighting: www.gelighting.com.
  - 2. Lutron Electronics Company, Inc; www.lutron.com.
  - 3. Philips Lighting Electronics/Advance: www.advance.philips.com.

- 4. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
- B. Ballasts General Requirements:
  - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- C. Fluorescent Ballasts:
  - 1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
    - a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
    - b. Total Harmonic Distortion: Not greater than 20 percent.
    - c. Power Factor: Not less than 0.95.
    - d. Ballast Factor: Low ballast factor between 0.75 and 0.85, unless otherwise indicated.
    - e. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
    - f. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
    - g. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
    - h. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
      - 1) Do not operate lamp(s) within the frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.
    - i. Lamp Current Crest Factor: Not greater than 1.7.
    - j. Lamp Wiring Method:
      - 1) Instant Start Ballasts: Parallel wired.
      - 2) Rapid Start Ballasts: Series wired.
      - 3) Programmed Start Ballasts: Provide parallel or series/parallel wired where available; otherwise series wired is acceptable.
    - k. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
    - I. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.
    - m. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
    - n. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class A, non-consumer application.
    - o. Provide high efficiency T8 lamp ballasts certified as NEMA premium.
    - p. Provide lamp striation reduction circuitry.
    - q. Ballast Marking: Include wiring diagrams with lamp connections.
  - 2. Non-Dimming Fluorescent Ballasts:
    - a. Lamp Starting Method:
      - 1) T8 Lamp Ballasts: Instant start unless otherwise indicated.
      - 2) T5 Lamp Ballasts: Programmed start unless otherwise indicated.
      - 3) Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.
    - b. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F, and energy saving lamp(s) at a minimum of 60 degrees F unless otherwise indicated.
    - c. Where dual level switching is indicated, provide two ballasts wired to operate part of the lamps in the luminaire or furnish a step dimming a ballast that will reduce output to 50% when only one switch is energized.
  - 3. Dimming Fluorescent Ballasts:
    - a. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker and with even tracking across multiple lamps.
    - b. Control Compatibility: Fully compatible with the dimming controls to be installed.
    - c. Lamp Starting Method: Programmed start unless otherwise indicated.

- d. Dimmed Lamp Starting: Capable of starting lamp(s) at any dimmed preset without transitioning first to full light output.
- 4. Bi-Level Stepped Dimming Linear Fluorescent Ballasts:
  - a. Bi-Level Operation: Capable of being switched between full light output on all lamps, 50 percent of full light output on all lamps, and all lamps off.
  - b. Control Compatibility: Capable of being controlled by standard manual light switches or occupancy sensors unless otherwise indicated.
  - c. Lamp Starting Method: Programmed start unless otherwise indicated.
  - d. Lamp Starting Temperature: Capable of starting lamp(s) at a minimum of 50 degrees F.
- D. Dimmable LED Drivers:
  - 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
  - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.

## 2.07 FLUORESCENT EMERGENCY POWER SUPPLY UNITS

- A. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Compatibility:
  - 1. Ballasts: Compatible with electronic, standard magnetic, energy saving, and dimming AC ballasts, including those with end of lamp life shutdown circuits.
  - 2. Lamps: Compatible with low-mercury lamps.
- C. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the fluorescent emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- D. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.
- E. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status and field selectable audible alert.
- F. Operating Temperature: From 32 degrees F to 122 degrees F unless otherwise indicated or required for the installed location.

## 2.08 LAMPS

- A. Manufacturers:
  - 1. General Electric Company/GE Lighting; : www.gelighting.com.
  - 2. Osram Sylvania; : www.sylvania.com.
  - 3. Philips Lighting Company; : www.lighting.philips.com.
  - 4. GE Company; Model .
  - 5. Westinghouse Electric Company.
  - 6. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
- B. Lamps General Requirements:
  - 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
  - 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
  - 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
  - 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Engineer to be inconsistent in perceived color temperature.
- C. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
  - 1. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
  - 2. Color Rendering Index (CRI): Not less than 80.

- 3. Average Rated Life: Not less than 10,000 hours for an operating cycle of three hours per start.
- D. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
  - 1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
  - 2. T8 Linear Fluorescent Lamps:
    - a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
    - b. Color Rendering Index (CRI): Not less than 80.
    - c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
  - 3. T5 Linear Fluorescent Lamps:
    - a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
    - b. Color Rendering Index (CRI): Not less than 80.
    - c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.

#### 2.09 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
- D. Tube Guards for Linear Fluorescent Lamps: Provide clear virgin polycarbonate sleeves with endcaps for lamps exposed in all occupied spaces (ie except storage rooms and closets)..
- E. As specified or as otherwise required for each luminaire. Provide all accessories required for a complete and operable fixture whether or not each such accessories are specified.

### PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### 3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26-05-37 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Suspended Ceiling Mounted Luminaires:
  - 1. Do not use ceiling tiles to bear weight of luminaires.
  - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
  - 3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members.

- 4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
- 5. Exposed Grid SuspendedCeilings: Support surface and recess mounted luminaires in grid and lay-in type ceilings directly from the building structure. Support luminaires from each corner with a separate and independent support wire. Identify fixture support wires by taping with red electrical tape to distinguish fixture support wires from ceiling grid support wires.
- F. Recessed Luminaires:
  - 1. Install trims tight to mounting surface with no visible light leakage.
  - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
  - 4. Install recessed luminaires to permit removal from below.
  - 5. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
  - 6. Install clips to secure recessed grid-supported luminaires in place.
- G. Suspended Luminaires:
  - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
  - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  - 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
  - 4. Install canopies tight to mounting surface.
- H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
- I. Support luminaires (except for compact flouorescent or incandescent can luminaires) from building structure independent of ceiling framing. Compact fluorescent or incandescent "can" type luminaires must be supported from the ceiling support grid and not from the ceiling tile or gypsum board.
- J. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- K. Install accessories furnished with each luminaire.
- L. Connect luminaires and exit signs to branch circuit outlets provided under Section 26-05-37 using flexible conduit.
- M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- N. Bond products and metal accessories to branch circuit equipment grounding conductor.
- O. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.
- P. Emergency Lighting Units:
  - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- Q. Exit Signs:
  - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- R. Fluorescent Emergency Power Supply Units:
  - 1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire or in remote location not exceeding manufacturer's recommended maximum conductor length to luminaire.
  - 2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.
- S. Remote Ballasts: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

- T. Identify luminaires connected to emergency power system in accordance with Section 26-05-53.
- U. Install lamps in each luminaire.
- V. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

## 3.04 FIELD QUALITY CONTROL

- A. See Section 01-40-00 Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.
- F. Replace all lamps and ballasts in luminaires that are defective prior to final acceptance.
- G. Replace fixtures or individual components of the fixtures that are damaged or permanently marked and cannot be restored to new condition.

## 3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Engineer or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Engineer or authority having jurisdiction.

## 3.06 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- B. Smudges, scrapes, scratches or other blemishes that cannot be cleaned or repaired will require that the fixture or individual fixture component (ie reflector, trim, door frame, lens, etc) be replaced.

### 3.07 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of luminaires to Engineer, and correct deficiencies or make adjustments as directed.
- B. Just prior to Substantial Completion, replace all lamps that have failed .

## 3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

# SECTION 26-56-00 EXTERIOR LIGHTING

#### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Ballasts.
- C. Lamps.
- D. Luminaire accessories.

#### 1.02 RELATED REQUIREMENTS

A. Section 26-05-37 - Boxes.

#### 1.03 REFERENCE STANDARDS

- A. ANSI C82.11 American National Standard for Lamp Ballasts High Frequency Fluorescent Lamp Ballasts Supplements.
- B. ANSI 05.1 American National Standard for Wood Poles -- Specifications and Dimensions.
- C. IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; Institute of Electrical and Electronic Engineers.
- D. IESNA LM-63 ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; Illuminating Engineering Society.
- E. IES LM-79 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society.
- F. IES LM-80 Approved Method: Measuring Lumen Maintenance of LED Light Sources; Illuminating Engineering Society.
- G. NECA 1 Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- H. NECA/IESNA 501 Recommended Practice for Installing Exterior Lighting Systems; National Electrical Contractors Association.
- I. NEMA 410 Performance Testing for Lighting Controls and Switching Devices with Electronic Fluorescent Ballasts; National Electrical Manufacturers Association.
- J. NEMA LE 4 Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association.
- K. NFPA 70 National Electrical Code; National Fire Protection Association.
- L. UL 935 Fluorescent-Lamp Ballasts.
- M. UL 1598 Luminaires.
- N. UL 8750 Light Emitting Diode (LED) Equipment for Use in Lighting Products.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
  - 2. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
  - 1. LED Luminaires:

- a. Include estimated useful life, calculated based on IES LM-80 test data.
- b. Include IES LM-79 test report for proposed substitutions.
- 2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
- 3. Lamps: Include rated life and initial and mean lumen output.
- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- C. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- D. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

## 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.
- C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

## 1.08 WARRANTY

A. Provide five year manufacturer warranty for all LED luminaires, including drivers.

### PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Acuity Brands, Inc: www.acuitybrands.com.
- B. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.
- C. Hubbell Lighting, Inc: www.hubbelllighting.com.
- D. GE Company.

## 2.02 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

### 2.03 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- I. LED Luminaires:
  - 1. Components: UL 8750 recognized or listed as applicable.
  - 2. Tested in accordance with IES LM-79 and IES LM-80.
  - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

### 2.04 BALLASTS

- A. Manufacturers:
  - 1. General Electric Company/GE Lighting: www.gelighting.com.
  - 2. Osram Sylvania: www.sylvania.com.
  - 3. Philips Lighting Electronics/Advance: www.advance.philips.com.
  - 4. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
- B. All Ballasts:
  - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- C. Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935. Ballasts shall be suitable for lamps specified and for the temperature range expected in the envrionment in which the luminaire is installed.
  - 1. Inrush Current: Not exceeding peak currents specified in NEMA 410.
  - 2. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
  - 3. Total Harmonic Distortion: Not greater than 20 percent.
  - 4. Power Factor: Not less than 0.95.
  - 5. Ballast Factor: Low ballast factor between 0.75 and 0.85, unless otherwise indicated.
  - 6. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
  - 7. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
  - 8. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
  - 9. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
    - a. Do not operate lamp(s) within the frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.
  - 10. Lamp Current Crest Factor: Not greater than 1.7.
  - 11. Lamp Wiring Method:
    - a. Instant Start Ballasts: Parallel wired.
    - b. Rapid Start Ballasts: Series wired.
    - c. Programmed Start Ballasts: Provide parallel or series/parallel wired where available; otherwise series wired is acceptable.
  - 12. Lamp Starting Method:
    - a. T8 Lamp Ballasts: Instant start unless otherwise indicated.
    - b. T5 Lamp Ballasts: Programmed start unless otherwise indicated.
    - c. Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.
  - 13. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F unless otherwise indicated.
  - 14. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
  - 15. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.

- 16. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
- 17. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class A, non-consumer application.
- 18. Ballast Marking: Include wiring diagrams with lamp connections.

### 2.05 LAMPS

- A. Manufacturers:
  - 1. General Electric Company/GE Lighting: www.gelighting.com.
  - 2. Osram Sylvania: www.sylvania.com.
  - 3. Philips Lighting Company: www.lighting.philips.com.
  - 4. GE Company.
  - 5. Westinghouse Electric Company.
  - 6. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
- B. Lamps General Requirements:
  - 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
  - 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
  - 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
  - 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Engineer to be inconsistent in perceived color temperature.
- C. Incandescent Lamps: Wattage and bulb type as indicated, with base type as required for lighting fixture; 130 V rated.
  - 1. Reflector Type Incandescent Lamps: Beam pattern as indicated.
  - 2. Non-Reflector Type Incandescent Lamps: Inside frosted lamp finish unless otherwise indicated.
- D. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
  - 1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
  - 2. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
  - 3. Color Rendering Index (CRI): Not less than 80.
  - 4. Average Rated Life: Not less than 10,000 hours for an operating cycle of three hours per start.
- E. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
  - 1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
  - 2. T8 Linear Fluorescent Lamps:
    - a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
    - b. Color Rendering Index (CRI): Not less than 80.
    - c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
  - 3. T5 Linear Fluorescent Lamps:
    - a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
    - b. Color Rendering Index (CRI): Not less than 80.
    - c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.

## 2.06 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

## PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### 3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26-05-37 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Recessed Luminaires:
  - 1. Install trims tight to mounting surface with no visible light leakage.
  - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
  - 4. Support rectangular recessed fixtures from the building structure with wire supports at the four corners of the fixture. Secure ceiling grids to fixtures with screws at corners.
  - 5. Round outlet fixtures installed in lay-in ceiling shall be secured to the ceiling grid with adjustable support frame to allow the fixture to be centered between the grids.
- F. Suspended Luminaires:
  - 1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
- G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
  - 1. Seal between junction box and wall before mounting fixture to box.
  - 2. Seal between top and sides of fixture and wall after installation of fixture to prevent water intrusion behind fixture and to allow drainage from bottom of fixture.
  - 3. Verify fit and integrity of lens gaskets to insure water and insect tight fit.
- H. Install accessories furnished with each luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.
- J. Adjust luminaires plumb and to align with wall features where applicable. Insure that luminaires are firmly and securely attached to the mounts and that there is minimal gap between the wall surface and the fixture.
- K. Unless the manufacturer's instructions indicate otherwise, seal between the wall and the luminaire at the top, the sides and 75% of the bottom with silicone or polyurethane sealant either clear paintable or matching the fixture color. Insure that wate trapped behind the fixture can drain from the bottom.
- L. Install lamps in each luminaire.

## 3.04 FIELD QUALITY CONTROL

A. See Section 01-40-00 - Quality Requirements, for additional requirements.

- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.

### 3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.
- B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Engineer.

## 3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

#### 3.07 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of luminaires to Engineer, and correct deficiencies or make adjustments as directed.
- B. Just prior to Substantial Completion, replace all lamps that have failed.

## 3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.