

**SPECIFICATIONS FOR:**

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**CAD/AVL REMODEL**



**CONTRACT NO. 12-STA-456**

**1230 West Boone Avenue  
Spokane, Washington**

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Project No. 111-12058  
December 21, 2012

SET # \_\_\_\_\_

**NAC** | ARCHITECTURE

1203 West Riverside  
Spokane, WA 99201  
(509) 838-8240

SPECIFICATIONS FOR:

CAD/AVL REMODEL  
Spokane Transit Authority  
1229 W. Boone Avenue  
Spokane, Washington 99205

ARCHITECTS:

NAC|ARCHITECTURE  
1203 West Riverside Avenue  
Spokane, Washington 99201  
(509) 838-8240 FAX (509) 838-8261

MECHANICAL ENGINEERS:

L & S ENGINEERING  
216 W Pacific Ave. Ste 211  
Spokane, Washington 99201  
(509) 747-2179 FAX (509) 747-2186

ELECTRICAL ENGINEERS:

NAC ENGINEERING  
1203 West Riverside Avenue  
Spokane, Washington 99201  
(509) 624-8125 FAX (509) 838-8261

FIRE PROTECTION ENGINEER:

L & S ENGINEERING  
216 W Pacific Ave. Ste 211  
Spokane, Washington 99201  
(509) 747-2179 FAX (509) 747-2186

DATE:

December 21, 2012

Section Title

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GENERAL CONTRACTOR PROPOSAL FORM  
(Submit 1 set of Forms)

Bidders:

Having carefully examined all Bidding Documents, Drawings, and Specifications entitled STA CAD/AVL Remodel, and having visited the site and examined all conditions affecting work, the undersigned proposes to furnish all labor, materials, equipment, and appliances necessary and required for the construction in accordance with the Plans and Specifications prepared by NAC|Architecture.

(NOTE: The amounts below shall EXCLUDE the Washington State Sales Tax. All blanks must be completed to make proposal acceptable.)

BASIC GENERAL CONSTRUCTION:

Basic Construction Bid (excludes State Sales Tax) in the amount of \_\_\_\_\_  
\_\_\_\_\_ Dollars (\_\_\_\_\_)

ALTERNATE BID NO. 1: PAINT EXISTING LOCKERS

\_\_\_\_\_  
\_\_\_\_\_ Dollars (\_\_\_\_\_)

ALTERNATE BID NO. 2: PROVIDE NEW LOCKERS

\_\_\_\_\_  
\_\_\_\_\_ Dollars (\_\_\_\_\_)

ALTERNATE BID NO. 3: REPLACE EXISTING DOORS

\_\_\_\_\_  
\_\_\_\_\_ Dollars (\_\_\_\_\_)

ALTERNATE BID NO. 4: PROVIDE COMMUNICATIONS STRUCTURED CABLING

\_\_\_\_\_  
\_\_\_\_\_ Dollars (\_\_\_\_\_)

COMPLETION OF THE WORK:

If the undersigned is notified of the acceptance of this proposal, it agrees to execute a Contract for the above work, for the above stated compensation, and to obtain Substantial Completion within 90 calendar days from the Notice to Proceed.

ADDENDA:

Receipt of Addenda number(s) \_\_\_\_\_ is hereby acknowledged.

BOND AND INSURANCE:

Undersigned agrees, if its proposal is accepted, to furnish and deliver to the Owner as soon as possible, but within 10 days, satisfactory evidence of ability to obtain a Performance Bond and Payment Bond in form and amount specified herein, and all required insurance certificates and policies.

LIQUIDATED DAMAGES:

For each calendar day after date established above that the work remains unavailable for occupancy and programmed use, the Contractor shall allow the Owner the sum of \$500.00, not to be construed in any sense a penalty, but as fixed, agreed liquidated damages incurred by the Owner for failure of the Contractor to meet the specified completion dates.

MECHANICAL HVAC SUBCONTRACTOR:

\_\_\_\_\_

MECHANICAL PLUMBING SUBCONTRACTOR:

\_\_\_\_\_

ELECTRICAL SUBCONTRACTOR:

\_\_\_\_\_

FIRE PROTECTION SUBCONTRACTOR:

\_\_\_\_\_

Submitted by \_\_\_\_\_  
(Firm Name of Bidder)

Mailing Address \_\_\_\_\_

Date \_\_\_\_\_ By \_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Typewritten Name)

\_\_\_\_\_  
(Title)

Members of Firm if Partnership

Address

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(Note: If bidder is corporation, write State of Incorporation under signature, and if a partnership, give full names of all partners.)

State of Washington Contractor's License No. \_\_\_\_\_

END OF GENERAL CONTRACTOR PROPOSAL FORM



SECTION 01 01 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of an interior tenant improvement project, approximately 3,830 sq. ft. at the Spokane Transit Authority, W. 1229 Boone Avenue, Spokane, Washington.

1.03 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the construction area in phases as defined herein and shown on the drawings. The Contractor's use of the premises is limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.
- B. Use of the Site: Limit use of the premises to work in areas as indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the building beyond the areas in which the Work is indicated.

1.04 COMPLETION TIME

- A. The Contractor agrees to complete the project as follows:
  - 1. Obtain Substantial Completion within 90 calendar days of the Notice to Proceed.

1.05 CONSTRUCTION PHASING

- A. The work area will be continuously occupied during construction. Construction will be completed in phases as described below:
  - 1. Phase 1: Rooms 111, 112, 114, 119 and 115 will be vacated. The Contractor shall have uninterrupted access in this area through completion. Rooms 106, 107, 108, 109 and 103 will be occupied during construction. These rooms shall be coordinated with the Owner's operation schedule and may require after hour or weekend work. Removal and replacement of lockers shall be completed in groups (banks or partial banks) to allow for continued owner usage. Complete all construction of Phase 1 before beginning Phase 2 work.
  - 2. Phase 2: Rooms 117 and 118 will be vacated at the end of Phase 1, the Contractor shall have uninterrupted access in this area through completion.

1.06 USE OF THE SITE

- A. Contractor's use of site areas for storage, work sheds, and related activities shall be coordinated and agreed to by the Owner.

1.07 PROJECT COMPLETION AND WARRANTY

- A. Certificates of Substantial Completion will be issued by the Architect. Warranty obligations shall commence with the issuance of the Certificate of Substantial Completion.

1.08 COORDINATION

- A. The Contractor and all subcontractors will be responsible for examination of the drawings and specifications to determine the effect of all bid documents on his bid. After bid opening, no allowance will be made for changes in project scope and/or price which would have been apparent by examination of all bid documents. Contractor is to report any discrepancies, omissions, or duplications to the Architect for clarification by Addendum prior to bid opening.
- B. Existing Utilities: Existing mechanical and electrical services shall remain operational throughout the project. Provide temporary services as required for construction. Complete new or temporary work and tie-ins prior to removing or relocating existing services.

END OF SECTION 01 01 00

SECTION 01 02 00 - PERMITS AND FEES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 PERMITS PAID FOR BY OWNER

- A. The Owner has submitted the construction documents and paid for the plan check fee to the City of Spokane, Washington. Do not include the cost of this fee in the bid.
- B. Contractor shall be responsible and pay for the building permit. Coordinate with the City of Spokane for pertinent payment details.

1.03 PERMITS PAID FOR BY CONTRACTOR

- A. Pay for all other permits and fees required by all other agencies having jurisdiction as per 3.7 of the General Conditions of the Contract.

PART 2 - PRODUCTS (Not applicable).

PART 3 - EXECUTION (Not applicable).

END OF SECTION 01 02 00

SECTION 01 02 70 - APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the 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".

1.03 SCHEDULE OF VALUES

- A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's 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 after the date of the "Notice to Proceed".
- 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. Dollar value.
- 3. Provide a breakdown of the total contract sum to a maximum of \$25,000 for any one line item. The Schedule of Values shall break out costs for material and for labor of each element of the work and for each trade or subcontractor. The complete Schedule of Values shall be submitted to the Owner for approval before the initial Application for Payment is submitted.
- 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. The Contractor shall include a line item for "PROJECT CLOSEOUT" equal to 2% of the contract amount. This amount will be due and payable after all punchlist and closeout items specified in Section 01700 are completed.
- 7. 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.

#### 1.04 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 Forms: Use AIA Document G702 and G703.
- D. 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 issued prior to the last day of the construction period covered by the application.
- E. Transmittal: Submit 4 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.

- F. 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. Submittal Schedule (preliminary if not final).
  7. Copies of building permits.
- G. 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.
- H. Administrative actions and submittals that shall proceed or coincide with this application include:
1. Occupancy permits and similar approvals.
  2. Warranties (guarantees) and maintenance agreements.
  3. Test/adjust/balance records.
  4. Maintenance instructions.
  5. Meter readings.
  6. Start-up performance reports.
  7. Change-over information related to Owner's occupancy, use, operation and maintenance.
  8. Final cleaning.
  9. Advice on shifting insurance coverages.
  10. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
- I. 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. Submittal of completed Affidavit of Wages Paid.
  8. Certified statement regarding Offshore Items.
  9. Labor and Industries Request for Release.
  10. Approval of Surety for release of retainage.
  11. Removal of temporary facilities and services.
  12. Removal of surplus materials, rubbish and similar elements.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION 01 02 70

SECTION 01 03 00 - ALTERNATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for Alternates.
- B. Definition: An Alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.
- C. Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project.
- D. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.
- E. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.01 SCHEDULE OF ALTERNATES

- A. Alternate No. 1, Paint Existing Lockers: Under the Basic Bid, do not paint the existing lockers. Under this Alternate, powder coat finish all existing lockers. Provide Corvell 3000 Series, TGIC polyester coating, or equal. Powder coat exterior surfaces only including doors, frames, end panels and sloped tops. Remove labels, stickers, graffiti, etc. Do not paint over original locker name plates, latches or padlock hasps. Prepare for painting by abrasive blast or other mechanical means. Carefully paint hinges to avoid cracking and paint peeling of hinge knuckles.
- B. Alternate No. 2, Provide New Lockers: Under the Basic Bid, re-use all existing lockers, except as noted as new. (Retain existing painted condition). Under this Alternate, provide all new two-tier metal lockers with sloped tops as specified in specification section 10 50 00 included herein.



- C. Alternate No. 3, Replace Existing Doors: Under the Basic Bid, Retain existing door, frames and hardware at Doors 115, 117 and 119. Under this Alternate, provide new wood doors (Door 115: Door Type A; Door 117: Door Type C; Door 119: Door Type A). Provide stain and varnish finish. Re-use existing door frames. Re-use existing door hardware at Door 115 and 117.
  
- D. Alternate No. 4, Provide Communications Structured Cabling: Under the Basic Bid, provide raceway and outlet boxes for copper, unshielded, twisted-pair (UTP) cabling. Under this Alternate, provide copper UTP cabling, jacks, faceplates, patch panels, terminations, labeling and cable testing for all new telecommunications outlets as specified in Section 27 15 11 and as indicated on the Drawings.

END OF SECTION 01 03 00

## SECTION 01 03 50 - MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 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 "Submittals" for requirements for the Contractor's Construction Schedule.
  - 2. Division 1 Section "Application for Payment" for administrative procedures governing applications for payment.
  - 3. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

#### 1.03 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 on the Architect's Document Clarification form. Sample copy is included at the end of this section.

#### 1.04 CHANGE 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 on a Change Proposal form by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
  - 1. Proposal requests issued are for information only. Do not consider them instruction 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 an estimate of cost necessary to execute the proposed change.
    - a. Prepare in accordance with Article 7. CHANGE IN THE WORK OF THE GENERAL CONDITIONS. Submit on the form furnished by the Architect a breakdown of quantities of labor and materials to be purchased and unit costs, along with the total amount of purchases to be made. Breakdown shall include a similar breakdown of work proposed by each subcontractor.
    - 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. No future consideration for time extension relating to this change will be entertained after acceptance by the Owner.

1.05 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Proposal request, the Architect may issue a Construction Change Directive, 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.

1.06 CHANGE ORDER PROCEDURES

- A. Upon approval of the Change Proposal, the Architect will issue a Change Order for the signature of the Contractor, as provided in the Conditions of the Contract.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION 01 03 50

SECTION 01 04 00 - COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
  - 1. General project coordination procedures.
  - 2. Conservation.
  - 3. Administrative and supervisory personnel.
  - 4. Cleaning and protection.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Project Meetings" for progress meetings, coordination meetings, and preinstallation conferences.
  - 2. Division 1 Section "Submittals" for preparing and submitting the Contractor's Construction Schedule.
  - 3. Division 1 Section "Materials and Equipment" for coordinating general installation.
  - 4. Division 1 Section "Contract Closeout" for coordinating contract closeout.

1.03 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. 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.

- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

## PART 2 - PRODUCTS (Not Applicable).

## PART 3 - EXECUTION

### 3.01 GENERAL COORDINATION 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. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

### 3.02 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect work 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 01 04 00

## SECTION 01 04 50 - CUTTING AND PATCHING

### PART 1 - GENERAL

#### 1.01 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.

#### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for cutting and patching.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Coordination" for procedures for coordinating cutting and patching with other construction activities.
  - 2. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
    - a. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 15 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.
    - b. Cost of providing penetration and any subsequent patching shall be borne by the trade requiring accommodation.

#### 1.03 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures well in advance of the time cutting and patching will be performed if the Owner requires approval of these procedures before proceeding. Request approval to proceed. Include the following information, as applicable, in the proposal:
  - 1. Describe the extent of cutting and patching required. Show how it will be performed and 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 will be performed.
  - 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities 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 adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement 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 unsatisfactory work.

#### 1.04 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.
  - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
    - a. Foundation construction.
    - b. Bearing and retaining walls.
    - c. Structural concrete.
    - d. Timber and primary wood framing.
    - e. Stair systems.
    - f. Miscellaneous structural metals.
    - g. Equipment supports.
    - h. Piping, ductwork, vessels, and equipment.
  
- B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.
  - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
    - a. Primary operational systems and equipment.
    - b. Air or smoke barriers.
    - c. Water, moisture, or vapor barriers.
    - d. Membranes and flashings.
    - e. Fire protection systems.
    - f. Noise and vibration control elements and systems.
    - g. Control systems.
    - h. Communication systems.
    - i. Conveying systems.
    - j. Electrical wiring systems.
  
- 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. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.
  - 1. If possible retain the original Installer or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original Installer or fabricator, engage another recognized experienced and specialized firm.
    - a. Processed concrete finishes.
    - b. Ornamental metal.
    - c. Matched-veneer woodwork.
    - d. Preformed metal panels.
    - e. Firestopping.
    - f. Window wall system.
    - g. Acoustical ceilings.
    - h. Carpeting.
    - i. Wall covering.



- j. HVAC enclosures, cabinets, or covers.

#### 1.05 WARRANTY

- A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS, GENERAL

- A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

#### PART 3 - EXECUTION

##### 3.01 INSPECTION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.
  - 1. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

##### 3.02 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. 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.

##### 3.03 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 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, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. 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 a diamond-core drill.
  4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.
  5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. 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. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
  2. 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.
  3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. 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 surface containing the patch after the area has received primer and second coat.
  4. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

### 3.04 CLEANING

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION 01 04 50

SECTION 01 20 00 - PROJECT MEETINGS

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
  - 1. Preconstruction conferences.
  - 2. Progress meetings.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Coordination" for procedures for coordinating project meetings with other construction activities.
  - 2. Division 1 Section "Submittals" for submitting the Contractor's Construction Schedule.

1.03 PRECONSTRUCTION CONFERENCE

- A. Schedule a preconstruction conference before starting construction, at a time convenient to the Owner and the Architect, but no later than 15 days after execution of the Agreement. Hold the conference at the Project Site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress, including the following:
  - 1. Tentative construction schedule.
  - 2. Critical work sequencing.
  - 3. Designation of responsible personnel.
  - 4. Procedures for processing field decisions and Change Orders.
  - 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. Parking availability.
  - 11. Office, work, and storage areas.
  - 12. Equipment deliveries and priorities.
  - 13. Safety procedures.
  - 14. First aid.
  - 15. Security.
  - 16. Housekeeping.

17. Working hours.

1.04 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project Site at regular intervals. Notify the Owner and the 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 the 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. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- 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 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 insure that current and subsequent activities will be completed within the Contract Time.
  - 2. Review the present and future needs of each entity present, including the following:
    - a. Interface requirements.
    - b. Time.
    - c. Sequences.
    - d. Status of submittals.
    - e. Deliveries.
    - f. Off-site fabrication problems.
    - g. Access.
    - h. Site utilization.
    - i. Temporary facilities and services.
    - j. Hours of work.
    - k. Hazards and risks.
    - l. Housekeeping.
    - m. Quality and work standards.
    - n. Change Orders.
    - o. Documentation of information for payment requests.
- D. Reporting: Architect will keep minutes and distribute to Owner and Contractor.
  - 1. Schedule Updating: Revise the Contractor's 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 01 20 00

## SECTION 01 30 00 - SUBMITTALS

### PART 1 - GENERAL

#### 1.01 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.

#### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Architectural and Engineering Drawings.
2. Contractor's construction schedule.
3. Submittal schedule.
4. Shop Drawings.
5. Product Data.
6. Samples.
7. Quality assurance submittals.

- 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, the following:

1. Permits.
2. Applications for Payment.
3. Performance and payment bonds.
4. Insurance certificates.
5. List of subcontractors.

- C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Applications for Payment" specifies requirements for submittal of the Schedule of Values.
2. Division 1 Section "Coordination" specifies requirements governing preparation and submittal of required Coordination Drawings.
3. Division 1 Section "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.
4. Division 1 Section "Quality Control" specifies requirements for submittal of inspection and test reports.
5. Division 1 Section "Contract Closeout" specifies requirements for submittal of Project Record Documents and warranties at project closeout.

#### 1.03 DEFINITIONS

- A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

- B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.
- C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

#### 1.04 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of 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 all related submittals are received.
  - 3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
    - a. Allow 2 weeks for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
    - b. If an intermediate submittal is necessary, process the same as the initial submittal.
    - c. Allow 2 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 by 5 inches (100 by 125 mm) 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 the Architect.
    - d. Name and address of the Contractor.
    - e. Name and address of the subcontractor.
    - f. Name and address of the supplier.
    - g. Name of the 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 handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. The Architect will not accept submittals received from sources other than the Contractor.
  - 1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
  - 2. Transmittal Form: Use the sample form at the end of this Section for transmittal of submittals.

#### 1.05 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule. Submit within 30 days after 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 the 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 submittal review, testing, and installation.
- C. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.
- D. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned 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 Division 1 Section "Applications for Payment" for cost reporting and payment procedures.
- E. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, 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.
- F. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

#### 1.06 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's Construction Schedule, the Contractor will complete the Submittal Schedule furnished by the Architect. Submit the schedule within 10 days of the date required for submittal 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.

#### 1.07 SHOP DRAWINGS

- A. Submittal of shop drawings, product data, and samples with their related approvals are required prior to final ordering of materials. The Architect's review of these submittals shall allow for the opportunity to make changes, correct conflicts, etc. without impact on the schedule or cost. If materials have been ordered prior to approval of specified submittals and changes are required, which if made prior to the ordering would not have affected the schedule or the cost, the contractor shall be required to make such changes at no cost to the Owner and without extension of the time of completion.
- B. Prior to transmitting shop drawings to the Architect, the Contractor shall review the submittal for completeness and accuracy, then stamp the submittal with his approval and forward to the Architect. All submittals lacking Contractor's approval will be returned to the Contractor for approval and resubmittal.
- C. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- D. 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 by sheet and detail number.
  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 by 11 inches but no larger than 30 by 40 inches.
  7. Submittal: Submit one correctable, translucent, reproducible print and two blue- or black-line prints for the Architect's review. The Architect will return the reproducible print.
  8. Do not use Shop Drawings without an appropriate final stamp indicating action taken.



## 1.08 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.
  - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
    - a. Manufacturer's printed recommendations.
    - b. Compliance with 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. Submittals:
    - a. For Review Only - No Approval Required: Submit 2 copies, 3 copies if Consultant review is required. No copies will be returned. Where required for Maintenance Manuals, Contractor will retain 3 similar copies for inclusion on the manuals.
    - b. For Approval: Submit 5 copies, 6 copies if Consultant review is required. 3 copies will be returned marked with action taken and corrections or modifications required. Where required for Maintenance Manuals, Contractor will revise if required and retain 3 copies for inclusion in the manuals.
    - c. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
    - d. Do not permit use of unmarked copies of Product Data in connection with construction.

## 1.09 QUALITY ASSURANCE SUBMITTALS

- A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
- B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
  - 1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
- C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

1.10 ARCHITECT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return. Compliance with specified characteristics is the Contractor's responsibility.
- B. Architect's review is for general conformance with the design concept and Contract Documents. If any deviations from the Contract Documents are included herein, such deviations shall be presumed by the Contractor as not having been reviewed by the Architects, except where specific emphatic attention is called to the change as a deviation. Markings or comments shall not be construed as relieving the Contractor from compliance with the project plans and specifications. The Contractor remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of assembly, and for performing his work in a safe manner.
- C. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked to indicate the action taken.
  - 1. 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 01 30 00

## SECTION 01 4 000 - QUALITY CONTROL

### PART 1 - GENERAL

#### 1.01 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.

#### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for quality-control services.
- B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
  - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- E. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Submittals" specifies requirements for development of a schedule of required tests and inspections.

#### 1.03 RESPONSIBILITIES

- A. Contractor Responsibilities:
- B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.
  - 1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.

- C. Associated Services: 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, the following:
1. Provide access to the Work.
  2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
  3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
  4. Provide facilities for storage and curing of test samples.
  5. Deliver samples to testing laboratories.
  6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
  7. Provide security and protection of samples and test equipment at the Project Site.
- D. Owner Responsibilities: The Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, or are provided by another identified entity. Costs for these services are not included in the Contract Sum.
1. The Owner will employ and pay for the services of an independent agency, testing laboratory, or other qualified firm to perform services which are the Owner's responsibility.
- E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. 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.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 01 40 00

## SECTION 01 42 10 - REFERENCE STANDARDS AND DEFINITIONS

### PART 1 - GENERAL

#### 1.01 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.

#### 1.02 DEFINITIONS

- A. General: Basic contract definitions are included in the Conditions of the Contract.
- B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.
- C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases.
- D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
- E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. Furnish/Install/Provide: The terms "Furnish" or "Install" or "Provide", unless specifically limited in context, mean: furnishing and incorporating a specified item, product or material in the work, including all necessary labor, materials, equipment to perform the work required, ready for use.
- G. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
  - 1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
  - 2. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
  - 3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However,

the ultimate responsibility for fulfilling contract requirements remains with the Contractor.

- a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.

H. “Project site” is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

I. “Testing Agencies”: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

#### 1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the 16-division format and CSI/CSC’s “MasterFormat” numbering system.

B. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.

- a. The words “shall,” “shall be,” or “shall comply with,” depending on the context, are implied where a colon (:) is used within a sentence or phrase.

#### 1.04 DRAWING SYMBOLS

A. Graphic Symbols: Where not otherwise noted, symbols are defined by “Architectural Graphic Standards”, published by John Wiley & Sons, Inc., eighth edition.

B. Mechanical/Electrical Drawings: Graphic symbols used on mechanical and electrical Drawings are generally aligned with symbols recommended by ASHRAE. Where appropriate, they are supplemented by more specific symbols recommended by technical associations including ASME, ASPE, IEEE and similar organizations. Refer instances of uncertainty to the Architect for clarification before proceeding.

#### 1.05 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as

if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.
- C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the Architect for a decision before proceeding.
  - 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.
- D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.
- E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

#### 1.06 GOVERNING REGULATIONS AND AUTHORITIES

- A. Copies of Regulations: Obtain copies of the following regulations and retain at the Project site to be available for reference by parties who have a reasonable need:
- B. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for the preparation of Contract Documents; that information may or may not be of significance to the Contractor. Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.
- C. Copies of Correspondence: During preparation of the Contract Documents, the Architect maintained a file of correspondence with authorities having jurisdiction. This file is available at the Architect's office for reference. If requested, the Architect will provide copies of correspondence at cost of reproduction.

#### 1.07 SUBMITTALS

- A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices,

receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION 01 42 10



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

## PART 1 - GENERAL

## 1.01 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.

## 1.02 SUMMARY

- A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.
- B. Temporary utilities include, but are not limited to, the following:
  - 1. Sanitary facilities.
- C. Support facilities include, but are not limited to, the following:
  - 1. Storage sheds.
  - 2. Waste disposal services.
  - 3. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
  - 1. Barricades, warning signs, and lights.
  - 2. Environmental protection.

## 1.03 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
  - 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 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
  - 1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

#### 1.04 PROJECT CONDITIONS

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

- A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

##### 2.02 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 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.
- C. 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. Do not exceed safe length-voltage ratio.
- D. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

#### PART 3 - EXECUTION

##### 3.01 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.

##### 3.02 TEMPORARY UTILITY INSTALLATION

- A. Temporary Electric Power Service: Connect to existing building power outlets. Coordinate connection point and power cord routing with Owner. Owner will pay for use charges.

- B. 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.

### 3.03 SUPPORT FACILITIES INSTALLATION

- A. Locate storage sheds and other temporary construction and support facilities for easy access. **Location of staging area shall be coordinated with the Owner.**
  - 1. Maintain 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. 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-site.
- C. 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 lawfully.

### 3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. 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.
- B. 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 that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

### 3.05 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.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, 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 the Contractor's property. The Owner reserves the right to take possession of project identification signs.

END OF SECTION 01 50 00

## SECTION 01 60 00 - MATERIALS AND EQUIPMENT

### PART 1 - GENERAL

#### 1.01 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.

#### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
  - 2. Division 1 Section "Submittals" specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.
  - 3. Division 1 Section "Substitutions" specifies administrative procedures for handling requests for substitutions made after award of the Contract.

#### 1.03 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 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 the manufacturer's product name, including make or model number or other designation, shown or listed 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 the United States and its possessions. Products 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 are also considered to be foreign products.
  - 2. "Materials" are products 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.

#### 1.04 SUBMITTALS

- A. Product List: Prepare a list showing products specified in tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.
1. Coordinate product list with the Contractor's Construction Schedule and the Schedule of Submittals.
  2. Form: Prepare product list 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 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. 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 List: Within 60 days after date of commencement of the Work, submit 3 copies of the completed product list. Provide a written explanation for omissions of data and for known variations from Contract requirements.
  5. Architect's Action: The Architect will respond in writing to Contractor within 2 weeks of receipt of the completed product list. No response within this 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 Architect's response will include a list of unacceptable product selections, containing a brief explanation of reasons for this action.

#### 1.05 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 Architect to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.
- B. Compatibility of Options: When the Contractor is given the option of selecting between 2 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.

- 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.
  - 2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply 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 that will be exposed to view in occupied spaces or on the exterior.
  - 1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are 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 that 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.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products according to 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 assure 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 an undamaged condition 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

### 2.01 ASBESTOS & OTHER HAZARDOUS MATERIALS RESTRICTIONS

- A. It is the intent of these specifications to exclude any equipment or material containing asbestos, formaldehyde or other hazardous (those restricted or prohibited by E.P.A.) materials. It shall be the responsibility of the Contractor to secure from suppliers and Sub-Contractors, certificates to the effect that products used on this project are asbestos-free and exclude other hazardous materials, whether specified or provided under the requirements for substitutions. Products installed in the work found to contain asbestos or other hazardous materials shall be removed and replaced as rejected work in accordance with the General Conditions.

### 2.02 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and 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: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
1. Proprietary Specification Requirements: Where Specifications name only a single product or manufacturer, provide the product indicated. No substitutions will be permitted.
  2. Semiproprietary Specification Requirements: Where Specifications name 2 or more products or manufacturers, provide 1 of the products indicated. No substitutions will be permitted.
    - a. Where Specifications specify products or manufacturers 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. Nonproprietary Specifications: When 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.



- 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 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 Architect's decision will be final on whether a proposed product matches satisfactorily.
  - a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.
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 Architect will select the color, pattern, and texture from the product line selected.

### PART 3 - EXECUTION

#### 3.01 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 01 60 00

## SECTION 01 63 10 - PRODUCT SUBSTITUTIONS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 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."

#### 1.03 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 or Architect.
  - 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.

#### 1.04 SUBMITTALS

- A. Requests for Substitutions After Award of Contract: 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 Architect.
  - 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.
  - 2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawings 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 for other parts of the Work and for 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. Architect's Action: Within one week of receipt of the request for substitution, the Architect 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, whichever is later, the Architect 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

### 2.01 SUBSTITUTIONS

- A. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; 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 Architect 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.
- B. The Contractor's submittal and Architect'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 01 63 10

## SECTION 01 70 00 - PROJECT CLOSEOUT

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
  - 1. Review 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.

#### 1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting review 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 documents 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. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
  - 3. Submit record drawings and similar final record information.
  - 4. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
  - 5. Complete final clean up requirements.
  - 6. Review Procedures: On receipt of the contractor's written request for review, the architect/engineer will either proceed with review or advise the contractor of unfilled prerequisites.
    - a. Following the initial review, the architect/engineer will prepare the Certificate of Substantial Completion, or will advise the contractor of work which must be performed (Punchlist Review items and Preliminary Procedures outlined above) before the certificate will be issued. The architect/engineer will repeat the review when requested and when assured that the work has been substantially completed. If the work is not

substantially complete after the repeat review, the architect shall record time consumed for additional reviews, submit it to the Owner and the amount for the additional time shall be deducted from the Construction Contract amount.

#### 1.04 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final review 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 review 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 consent of surety to final payment.
  5. Submit a final liquidated damages settlement statement.
  6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Final Review Procedure: The architect/engineer will schedule a final review of the work upon receipt of notice that the work, including punch-list items from earlier reviews, has been completed, except items whose completion has been delayed because of circumstances acceptable to the architect/engineer.
1. Upon completion of final review, the architect/engineer will prepare either a certificate of final acceptance, or will 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, the final review procedure will be repeated. If the work is not complete, the architect will record time consumed, submit it to the Owner and the amount for the additional time shall be deducted from the Construction Contract amount.

#### 1.05 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. Prior to completion of the work, the Contractor shall transfer all record drawings to permanent reproducible bond paper. Changes and information shall be neatly and clearly drawn and described and shown technically correct. All costs associated with the record drawings, including the final bond copy shall be borne by the Contractor. The Architect and his consultants will make their electronic drawing files available to the Contractor for production of bond copies.
  5. Contractor shall submit the record drawings (actual marked-up prints and a preliminary marked-up bond copy) to the Architect for review and shall make such revisions or corrections as may be necessary for the drawings to be a true, complete and accurate record of the work. After final corrections are complete submit a complete electronic set in PDF format plus one (1) full size hard copy set for the Owner's records.
- 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 the 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. 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.
1. All manufacturer's warranty and guarantee forms completely executed. Include single-year, multi-year and lifetime warranties.
  2. Operating instructions for any special equipment included.
  3. Manufacturer's recommendation for care, cleaning and maintenance.
  4. Catalog cuts and repair parts list for all elements of equipment provided.
  5. A complete list of all subcontractors and vendors, with addresses.
  6. A complete list of all products used in the general construction portion of the contract.
  7. One complete set of approved shop drawings. Organized per Specification Divisions and delivered in labeled cartons. Note, only one set of shop drawings is required for general construction work to accompany the manuals described herein.

For ease of collection, they may be the set used by the Architect's Representative at the site.

8. One complete set of product submittals (approved copies).
- F. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Submit 3 copies to the Architect for the Owner's record. Include the following types of information:
1. Emergency instructions.
  2. Spare parts list.
  3. Copies of warranties.
  4. Shop Drawings and Product Data.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".
- B. Cleaning: Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
  1. Clean the site, including landscape development areas, of rubbish, litter and 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. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- D. 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 01 70 00



## SECTION 017400 - WARRANTIES AND BONDS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 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 installation 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.

#### 1.03 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.

#### 1.04 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. Minimum period: 6 months after corrective work completed.
- 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 benefited 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, right 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.

#### 1.05 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect'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 Architect.
  - 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 Architect 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 Architect for approval prior to final execution.
- C. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or the Contractor and subcontractor, supplier or manufacturer. Submit a draft to the Owner through the Architect 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.
- D. 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.
- E. 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 (Not Applicable).

END OF SECTION 017400

SECTION 02 07 00 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 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.

1.02 DESCRIPTION OF WORK:

- A. Extent of selective demolition work is shown on drawings.
- B. Types of Selective Demolition Work: Demolition and subsequent offsite disposal or relocation includes, but is not limited to the following:
  - 1. Removal of interior partitions as indicated on drawings.
  - 2. Removal of doors and frames.
  - 3. Removal of existing floor coverings and adhesive.
  - 4. Removal of existing ceilings.
  - 5. Removal of existing casework as indicated on drawings.
  - 6. Removal of CMU walls for new door openings.
  - 7. Removal of existing fixtures and equipment items.
  - 8. All other demolition required for new construction.
- C. Related work specified elsewhere:
  - 1. Remodeling construction work and patching is included within the respective sections of specifications, including removal of materials for re-use and incorporated into remodeling or new construction.
  - 2. Relocation of pipes, conduits, ducts, other mechanical and electrical work are specified by respective trades.

1.03 JOB CONDITIONS:

- A. Owner Use of Existing Work Area: The Owner will be occupying the entire work area during construction. The Contractor shall coordinate the work and schedule with the Owner and make provisions for alternative work hours, without additional cost to complete the work within the stipulated time frame. See also Section 01 01 00 for Construction Phasing.
- B. Condition of Structures: Owner assumes no responsibility for actual condition of structures to be demolished.
  - 1. Conditions existing at time of commencement of contract will be maintained by Owner in so far as practicable.
- C. Partial Demolition and Removal: Items of salvageable value to Contractor may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed.
  - 1. Storage or sale of removed items on site will not be permitted.
  - 2. The Contractor is responsible for security of salvaged items to be re-used which remain in the Contractor's sole care, custody, and control.

- D. Protections: Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition work.
  - 1. Provide protective measures as required to provide free and safe passage of Owner's personnel and general public around the site perimeter.
  - 2. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished, and adjacent facilities or work to remain.
  - 3. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
  - 4. Protect floors with suitable coverings when necessary.
  - 5. Remove protections at completion of work.
- E. Asbestos: It is expected that asbestos may be encountered in the course of this Contract. If any materials suspected of containing asbestos are encountered, do not disturb the materials. Immediately notify the Architect and the Owner.
- F. Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.
- G. Traffic: Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
  - 1. Do not close, block or otherwise obstruct streets, walks or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- H. Explosives: Use of explosives will not be permitted.
- I. Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.
- J. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
- K. Environmental Controls: Use temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.
  - 1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable).

PART 3 – EXECUTION

3.01 INSPECTION:

- A. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Owner's Representative prior to starting work.

### 3.02 PREPARATION:

- A. Provide interior and exterior shoring, bracing or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.
  - 1. Cease operations and notify the Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
- B. Cover and protect equipment and fixtures to remain from soiling or damage when demolition work is performed in rooms or areas from which such items have not been removed.
  - 1. Do not commence demolition in vicinity of salvaged items until salvage is complete and all such items are not exposed to demolition damage.
- C. Locate, identify, stub off and disconnect utility services that are not indicated to remain.
- D. Temporary Shoring: Provide and maintain interior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.

### 3.03 DEMOLITION:

- A. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
  - 1. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-drive masonry saw or hand tools; do not use power-driven impact tools.
  - 2. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors or framing.
  - 3. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
  - 4. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.
  - 5. Non-Loadbearing Wall Removals: Remove in a manner that will cause no damage to the existing structure. Remove completely, leaving no protrusion at the floors, walls or ceilings that will interfere with the placement of new finishes.
  - 6. Floor Covering Removal: Remove with hand spade or other similar tool. Remove sufficient adhesive so as not to impair placement of new flooring.
  - 7. Door Removal: Doors shall be removed complete with all hardware including hinges. Note doors to be salvaged and re-used.

8. Removal of All Incidental Furnishings: Remove all incidental cabinets, specialties, furnishings, chalkboards, bulletin boards, display cases, directories, etc. wherever such items interfere with new construction. Note salvage requirements as shown on Drawings.
  9. Ceiling Removals: Wherever new ceilings are to be installed, remove existing ceilings and dispose of same. Remove complete with lighting fixtures and other ceiling elements, unless noted otherwise on the drawings.
  10. Existing Incidental Mechanical/Electrical Items: Disconnection of services and demolition of mechanical/electrical items will be performed as specified in Divisions 15, 16. However, removal of conduit, J-boxes, and other incidental disconnected items is the responsibility of the General Contractor -- to the extent that such incidental items are concealed or embedded in walls or other elements that the General Contractor is required to remove anyway. In addition, remove all incidental abandoned and disconnected mechanical devices (controls, small grilles, thermostats, etc.) which would otherwise be exposed to view. These requirements apply at interior and exterior.
  11. Remove all other miscellaneous, non-structural items that would otherwise interfere with reconstruction.
- B. If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative rearrange selective demolition schedule as necessary to continue overall job progress without delay.

3.04 SALVAGE MATERIALS:

- A. Salvage Items: Where indicated on Drawings as salvage, carefully remove indicated items, clean, store and turn over to Owner or re-install as noted on Drawings.

3.05 DISPOSAL OF DEMOLISHED MATERIALS:

- A. Remove debris, rubbish and other materials resulting from demolition operations from building site. Transport and legally dispose of materials off site.
1. Burning of removed materials is not permitted on project site.

3.06 CLEAN-UP AND REPAIR:

- A. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.
- B. Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 02 07 00

## SECTION 06 10 00 – ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.01 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.

#### 1.02 SUMMARY

- A. Types of work in this section include rough carpentry for:
  - 1. Blocking and bracing for anchorage of cabinets, toilet accessories, fixtures, door stops, equipment and any other wall-mounted or secured items of the project.
  - 2. Miscellaneous wood framing.
  - 3. Wood grounds, nailers, furring and blocking.
  - 4. Plywood backing panels.
  - 5. Floor Sheathing.

#### 1.03 QUALITY ASSURANCE

- A. Factory-mark each piece of material with type, grade, mill and grading agency identification.

#### 1.04 PRODUCT 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 material.
  - 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.
- B. Do not deliver finish carpentry materials, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, finish carpentry materials just be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

#### 1.05 PROJECT CONDITIONS

- A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other work.
- B. Conditioning: Installer shall advise Contractor of temperature and humidity requirements for finish carpentry installation areas. Do not install finish carpentry until required temperature and relative humidity have been stabilized and will be maintained in installation areas.

### PART 2 - PRODUCTS



## 2.01 LUMBER, GENERAL

- A. Lumber Standards: Manufacture lumber 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: Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at times of surfacing, and mill.
  - 1. For exposed lumber apply grade stamps to ends or back of each piece, or omit grade stamps entirely and issue certificate of grade compliance from inspection agency in lieu of grade stamp.
- C. 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.
  - 2. Provide seasoned lumber with 19% maximum moisture content at time of dressing and shipment for sizes 2” or less in nominal thickness, unless otherwise indicated.
  - 3. Provide lumber with 15% maximum moisture content at time of dressing and shipment for sizes 2” or less in nominal thickness, unless otherwise indicated.

## 2.02 DIMENSIONAL LUMBER

- A. For light framing (2” to 4” thick, 2” to 4” wide), provide the following grade:
  - 1. No. 2 and Better Douglas Fir and Larch species.

## 2.03 MISCELLANEOUS LUMBER

- A. Provide wood for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:
  - 1. Moisture content: 19% maximum for lumber items not specified to receive wood preservative treatment.
  - 2. 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. 3 boards per SPIB rules.
  - 3. Preservative Treated Wood: Provide at all dimensional lumber related to roofing and flashing.

## 2.04 CONCEALED, PERFORMANCE-RATED STRUCTURAL-USE PANELS:

- A. General: Where structural-use panels are indicated for the following concealed types of applications, provide APA-performance-rated panels complying with requirements designated under each application for grade, span rating, exposure durability classification, and edge detail (where applicable).
  - 1. Thickness: Provide panels meeting requirements specified but not less than thickness indicated.
  - 2. Span Ratings: 24

- B. Floor Sheathing: APA-rated sheathing.
  - 1. Exposure Durability Classification: Exposure 1.
  - 2. 3/4" APA-rated Sturd-I-Floor with tongue and groove edges.

#### 2.05 STRUCTURAL-USE PANELS FOR BACKING:

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch (11.9 mm) thick.

#### 2.06 MISCELLANEOUS MATERIALS

- A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.
  - 1. Where rough carpentry work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153).

### PART 3 - EXECUTION

#### 3.01 INSTALLATION, GENERAL

- A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.
- B. Set carpentry work accurately to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.
- D. Use common wire nails, except as 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; pre-drill as required.
- E. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

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

- A. Provide wherever 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.
- C. Provide permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2" wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

### 3.03 WOOD FRAMING, GENERAL

- A. Provide framing members of sizes and on spacings shown, and frame openings as shown, or if not shown, comply with recommendations of "Manual for House Framing" of National Forest Products Association (N.F.P.A.). Do not splice structural members between supports.
- B. Anchor and nail as shown, and to comply with "Recommended Nailing Schedule" of "Manual for House Framing" and "National Design Specifications for Wood Construction" published by N.F.P.A.

### 3.04 INSTALLATION OF CONSTRUCTION PANELS

- A. General: Comply with applicable recommendations contained in Form No. E 30F, "APA Design/ Construction Guide - Residential & Commercial," for types of construction panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Sheathing: Flat head screw attachment to framing.
  - 2. Plywood Backing Panels: Nail or screw fasten to supports.

END OF SECTION 06 10 00

## SECTION 06 40 20 - INTERIOR ARCHITECTURAL WOODWORK

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Laminate-clad cabinets (plastic-covered casework).
  - 2. Plastic-laminate and solid surface countertops.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 6 Section "Carpentry" for exposed framing and for furring, blocking, shims, and hanging strips for installing interior woodwork.
  - 2. Division 8 Section "Flush Wood Doors" for doors specified by reference to architectural woodwork standards.

#### 1.03 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction prior to woodwork installation.

#### 1.04 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 and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
- C. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.
  - 3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
- D. Samples for verification of the following:
  - 1. Lumber with or for transparent finish, 50 sq. in. (300 sq. cm), for each species and cut, finished on one side and one edge.
  - 2. Wood-veneer-faced panel products, with or for transparent finish, 8 by 10 inches (200 by 250 mm), for each species and cut. Include at least one face-veneer seam and finish one-half of face as specified.

- a. Step finish materials on sample to show and clearly define each coat.
  3. Lumber and panel products with shop-applied opaque finish, 8 by 10 inches (200 by 250 mm) for panels and 50 sq. in. (300 sq. cm) for lumber, for each finish system and color, with one-half of exposed surface finished.
  4. Laminate-clad panel products, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
  5. Thermoset decorative-overlay surfaced panel products, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
  6. Exposed cabinet hardware, one unit for each type and finish.
- 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.

#### 1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.
- B. Installer Qualifications: Arrange for interior architectural woodwork installation by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.
- C. Quality Standard: Except as otherwise indicated, comply with the following standard:
1. AWI Quality Standard: “Architectural Woodwork Quality Standards” of the Architectural Woodwork Institute for grades of interior architectural woodwork, construction, finishes, and other requirements.
    - a. Provide AWI Certification Labels or Certificates of Compliance indicating that woodwork meets requirements of grades specified.
  2. The Contract Documents contain selections chosen from options in the Quality Standard as well as additional requirements beyond those of the Quality Standard. Comply with such selections and requirements in addition to the Quality Standard.
- D. Fire-Test-Response Characteristics: Provide materials with the following fire-test-response characteristics as determined by testing identical products per ASTM test method indicated below by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify fire-retardant-treated material with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
1. Surface-Burning Characteristics: Not exceeding values indicated below, tested per ASTM E 84 for 30 minutes with no evidence of significant combustion. In addition, the flame front shall not progress more than 10-1/2 feet (3.2 m) beyond the center line of the burner at any time during the test.
    - a. Flame Spread: 25.

- b. Smoke Developed: 450.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
- B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

#### 1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Obtain and comply with woodwork fabricator's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork will be within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.
- B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.
  - 2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

#### 1.08 COORDINATION

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

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and, where the following products are part of interior woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:
  - 1. Hardboard: AHA A135.4.
  - 2. Particleboard: ANSI A208.1, Grade M-2.
  - 3. Softwood Plywood: PS 1.
  - 4. Hardwood Plywood and Face Veneers: HPVA HP-1.
- B. Particleboard: ANSI A208.1, Grade M-2 made with phenol-formaldehyde resins.

- C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
  - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by the following (with architect given free selection among all listed):
    - a. Wilsonart.
    - b. Nevamar Corp.
    - c. Lamin-Art.
- D. Adhesive for Bonding Plastic Laminate: Contact cement.
- E. Thermoset Decorative Overlay: Decorative surface of thermally fused polyester or melamine-impregnated web, bonded to specified substrate and complying with ALA 1992.
  - 1. Substrate: Medium-density particleboard.
  - 2. Color: Almond.
- F. Thermofused Decorative Panels: Melamine resin impregnated decorative paper, thermally fused to particle board or medium density fiberboard (MDF)
  - 1. Product: Panolam Industries
  - 2. Color: As shown on the Room Finish Schedule.

## 2.02 CABINET HARDWARE AND ACCESSORY MATERIALS

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Cabinet Hardware Schedule: Refer to schedule below for cabinet hardware required for architectural cabinets.
- C. Hardware Standard: Comply with BHMA A156.9 for items indicated by reference to BHMA numbers or referenced to this standard.
- D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA code number indicated.
  - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base. (HCU)
  - 2. Satin Stainless Steel, Stainless-Steel Base: BHMA 630. (HCU)
- E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of BHMA A156.9.
- F. Hardware Schedule:
  - 1. Hinges: Heavy-duty, fully concealed European style, equal to products of Blum 170° clip hinge.
  - 2. Pulls: Stanley No. 4483-1/2, or equivalent.
  - 3. Locks: Olympus Lock, Inc. #100R and #200 DW, National Keyway, keyed as required by Owner. Furnish two keys per lock and grand master key. Each lock to have pin tumblers and metal strike plate.

- a. Elbow Catch at Fixed Leaf of Cabinet Door Pairs: Cast or milled product equal to Ives 2A92. No stamped metal catches are permitted.
4. Roller Guides for Drawers: AL-FIT 1702, or equal Blum Drawer Rollers, full extension.
5. Catches: Amerock 9798, heavy duty magnetic catch. Omit magnetic catches at doors outfitted with hinges having self-closing feature which holds doors closed tight.
6. Shelf Supports at Cabinets: Metal pin support style for drilled holes in cabinet body.
7. Silencers: Provide rubber silencers at inside lip of door and drawer fronts.
8. Filler Strips: Furnish filler strips for continuous application around perimeter edges of recessed cabinets and in other locations shown on the Drawings and specified herein. Match adjacent cabinetry.
9. Electrical Cord Grommets: Doug Mocket & Co. Model SG and cap. (800) 523-1269. Provide one (1) each per full space unless shown otherwise.
10. CPU Holder: Doug Mockett MQCPUIBK Underdesk CPU Holder – 27 lb. rating.
11. Undercounter Support Brackets: Generic steel support fabricated from minimum 1/8" steel, sized and rated for full counter depth. Black Powder coat finish.

#### 2.03 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1 for applicable requirements.
  1. For metal framing supports, provide screws as recommended by metal-framing manufacturer.
- C. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

#### 2.04 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide interior woodwork complying with the referenced quality standard and of the following grade:
  1. Grade: Custom.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to relative humidity conditions existing during time of fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:



1. Corners of cabinets and edges of solid-wood (lumber) members 3/4 inch (19 mm) thick or less: 1/16 inch (1.5 mm).
  2. Edges of rails and similar members more than 3/4 inch (19 mm) thick: 1/8 inch (3 mm).
  3. Corners of cabinets and edges of solid-wood (lumber) members and rails: 1/16 inch (1.5 mm).
  4. Radius all countertop corners, 1-1/2 inch radius.
- D. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Trial fit assemblies at the fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on approved shop drawings before disassembling for shipment.
- E. Shop-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.

## 2.05 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 300.
1. Grade: Custom
- B. 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.
- C. Wood Species: White Oak, plain sliced.

## 2.06 LAMINATE-CLAD CABINETS (PLASTIC-COVERED CASEWORK)

- A. Quality Standard: Comply with AWI Section 400 requirements for laminate-clad cabinets.
1. Grade: Custom.
- B. AWI Type of Cabinet Construction: Flush overlay.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
1. Horizontal Surfaces Other than Tops: GP-50, 0.050-inch (1.270-mm) nominal thickness.
  2. Postformed Surfaces: PF-42, 0.042-inch (1.067-mm) nominal thickness.
  3. Vertical Surfaces: GP-28, 0.028-inch (0.711-mm) nominal thickness.
  4. Edges:
    - a. Counter Edges: 3 mm PVC, unless noted otherwise.

- b. Doors, Drawer Fronts and Drawer Edges: Heavy duty extruded PVC edge banding, minimum 2 mm thick, machine applied with waterproof hot melt adhesive; exposed corners and edges to be trimmed and buffed. Equal to Doellken – Wood Tape.
  - c. Color: Match adjoining laminate.
- D. Extent of Plastic Laminate Finish: Apply plastic laminate to all surfaces exposed to view when doors and drawers are closed, except edging as specified elsewhere herein. Non-exposed cabinet interiors and shelving may have factory finished thermally fused melamine. Shelving on standards and brackets may be factory finished thermally fused melamine.
- E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
- 1. Match color, pattern, and finish indicated by reference to laminate manufacturer's standard designations for these characteristics.

## 2.07 COUNTERTOPS

- A. Quality Standard: Comply with AWI Section 400 requirements for countertops.
- 1. Grade: Custom.
- B. Type of Top: High-pressure decorative laminate complying with the following:
- 1. Grade: GP-50, 0.050-inch (1.270-mm) nominal thickness.
  - 2. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
    - a. Match color, pattern, and finish indicated by reference to manufacturer's standard designations for these characteristics.
  - 3. Edge Treatment: Doelken Wood Tape edge band, 3 mm, 1 5/16" wide. Corner Treatment: 1 1/2" radius typical.
  - 4. Core Material: Phenolic resin, medium-density particleboard.

## 2.08 ADJUSTABLE SHELVING

- A. Quality Standard: Comply with AWI Section 600.
- B. Shelving Materials: Medium density (45 lbs.) polyester overlay board or thermally fused melamine with hot melt PVC edging. Provide laminate clad shelving if indicated on Drawings. Thickness: 3/4" for spans 30" or less, 1" for spans greater than 30".

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

### 3.02 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) for plumb and level (including tops).
- C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where necessary. Stagger joints in adjacent and related members.
  - 1. Install standing and running trim with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) variation from a straight line.
- F. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
  - 2. Maintain veneer sequence matching of cabinets with transparent finish.
- G. Tops: Anchor securely to base units and other support systems as indicated. Caulk space between backsplash and wall with specified sealant.
  - 1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
- H. Complete the finishing work specified in this Section to the extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in the shop.
- I. Refer to Division 9 Sections for final finishing of installed architectural woodwork.

### 3.03 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

#### 3.04 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 06 40 20

## SECTION 07 84 10 – PENETRATION FIRESTOPPING

### PART 1 – GENERAL

#### 1.01 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work specified in this section.

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Provide firestopping and smoke seals in floors, ceilings and fire-rated wall assemblies, both empty and those accommodating penetrating items such as cables, cable trays, conduits, pipes, ducts, etc. Firestopping is limited to the construction envelope surrounding the limits of Work.
- B. Responsibility: This Section contains requirements for firestopping and smoke barrier penetration seals around pipes, ducts, conduits, etc., in walls, partitions, ceilings and floors. The trades for Mechanical and Electrical Work of this Contract shall be responsible for providing required sleeves and for sealing said penetrations in accordance with requirements of this Section.

#### 1.03 PERFORMANCE REQUIREMENTS

- A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.
  - 1. Firestop system is defined as the combination of materials, including the penetrating items, required to make a complete firestop, including sleeves and backing materials.
  - 2. Provide firestop assemblies that have been tested in accordance with ASTM E814 (UL 1479), including passage of hose stream test; fire tests shall have been conducted at a minimum 0.01 inches water positive pressure.
  - 3. Firestop materials must be labeled or listed by Underwriters Laboratories, Inc., Warnock Hersey International, Inc., or other testing agency with follow-up service that is acceptable to authorities having jurisdiction.
- B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F-ratings, as determined per ASTM E814, but not less than that equaling or exceeding the fire resistance rating of the construction penetrated.
- C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T-ratings, in addition to F-ratings, as determined per ASTM E814. Provide T-rated assemblies at those through-penetrations as specified in IBC Section 712.

D. Special Conditions:

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestops systems.
2. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
4. For firestopping exposed to view, provide products with flame spread of 25 or less and smoke development of 450 or less when tested per ASTM E84.

1.04 SUBMITTALS

- A. General: Make submittals in accordance with Section 01 33 23.
- B. Certificates of Compliance: Submit manufacturer's certificates of compliance stating that the firestopping and smoke seal material, or combination of materials meet the requirements specified and is recommended for the applications indicated. If requested, furnish complete test reports from Independent Laboratory.
- C. Product Data: Submit manufacturer's product data, including material composition, performance and limitation criteria, and installation procedures for each type of firestopping and smoke seal material required.
- D. Drawings: Submit firestop system drawings showing each condition requiring penetration seals indicating proposed UL or Warnock Hersey listing numbers, installation methods and relationships to adjoining construction. For un-tested penetrations, submit firestop manufacturer's engineering judgments which reference related UL system(s). Include a schedule showing each firestop and smoke seal material.

1.05 QUALITY ASSURANCE

- A. Material Qualifications: Provide only materials tested and certified to conform with specified requirements. Flame spread rating must be a minimum of one (1) hour, but not less than the fire resistance rating of the assembly being penetrated.
- B. **Single Source: Obtain through-penetration firestop systems for all kinds of penetrations and construction condition indicated from a single manufacturer.**
- C. Un-Tested Penetrations: For mechanical and electrical penetrations which have characteristics (e.g. pipe material and diameter, pipe insulation type and thickness, type of wall that is penetrated) that have not been tested in accordance with ASTM E814 by any firestop manufacturer, provide a written judgment from the proposed firestop manufacturer stating that the manufacturer's firestop material will meet the requirements for successfully passing the tests in or ASTM E814.
  1. The written judgment shall contain firestop installation procedures (e.g. sleeve material and size, space requirements, quantity of firestop material required).

2. If required, submit written judgments to the local building code authorities and obtain their approval before submitting to Architect for their review.
- D. Installer's Qualifications: Engaged an experienced Installer who has completed firestopping that is similar in material, design, and extent to that indicated for Project and that has performed successfully.
- E. Special Inspections: Refer to article entitled "Field Quality Control" of this Section for special inspection which shall be performed by Owner's inspection agency.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- A. General: Comply with requirements specified in Section 01 60 00.
- B. Deliver materials undamaged in manufacturer's unopened containers or packages identified with brand, type, grade, and UL label. Coordinate delivery with scheduled installation date to minimize storage time at site. Leave seals unbroken and labels intact until time of use. Remove from job site rejected or damaged packages found unsuitable for use. Store materials in clean, dry, ventilated location. Follow manufacturer's instructions.

#### 1.07 PROJECT CONDITIONS

- A. General: Conform to manufacturer's printed instructions for installation and, when applicable, curing recommendations regarding temperature and humidity. Provide adequate ventilation if using solvent. Provide forced air ventilation during installation, if required by manufacturer. Keep flammable materials away from sparks or flame.
- B. Coordination With Other Trades: Coordinate annular space, sleeve and insulation requirements with work of Divisions 15 and 16. Firestopping or smoke seal material at penetrations of insulated pipes shall be applied after the insulation is installed. The material selected for use with insulated pipes shall have been tested in accordance with ASTM E814 or U.L. 1479 for that particular insulated pipe assembly.

#### 1.08 SEQUENCING AND SCHEDULING

- A. General: Notify Owner's inspection agency at least 5 days in advance of firestopping installations; confirm dates and times on days preceding each series of installations. Do not cover up those firestopping installations that will become concealed behind other construction until Owner's inspection agency and authorities having jurisdiction have examined each installation.

### PART 2 - PRODUCTS

#### 2.01 FIRESTOPPING AND SMOKESEALS

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and applications, as demonstrated by firestopping manufacturer based on testing and field experience.

- B. Firestopping and Smoke Seal Materials: Asbestos free, complying with system “Performance Requirements” as previously specified. Firestop materials shall not emit hazardous, combustible or irritating fumes during installation, curing or use.
  - 1. Materials to include intumescent fire pillows, heat sealed in fire-retardant poly bag. Pillow shall be UL classified and/or FM systems approved and tested per ASTM E814. Spec Seal “Pillows”, or approved equal.
- C. Manufacturers: It is the responsibility of the trade subcontractor to select the appropriate firestop system for type of penetration and construction indicated. **Note: All firestopping materials on the project are to be from a single manufacturer.**

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping. Remove laitance and form release agents from concrete.
- B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer’s recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Mask where necessary to protect adjoining surfaces. Remove excess material and stains on surfaces as required.

#### 3.02 INSTALLATION

- A. General: Comply with the article entitled “Performance Requirements” of this Section and the through-penetration firestop manufacturer’s installation instructions and drawings pertaining to products and applications indicated. Provide firestopping material in the following locations:
  - 1. Mechanical and electrical penetrations (e.g. insulated and non-insulated pipe, tubing, wiring, raceways, cable and conduit penetrations, cable trays, busways, and ductwork without fire or smoke-fire dampers) through floor slabs and through time rated partitions, ceilings, fire walls and smoke walls.
  - 2. Unused openings in floor slabs and time-rated partitions and walls.
  - 3. Other locations indicated, specified or required by codes or local authorities.
- B. Accessories: Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.



- C. Installation: Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
  - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
  - 2. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.03 CLEAN-UP

- A. After completion of application of firestopping or smoke seal materials, remove debris, excess materials, and broom clean exposed wall and floor areas. Neatly cut and trim materials as required.
- B. When finished work will be visible, remove temporary dams and clean adjacent surfaces in accordance with manufacturer's printed instructions. Remedy staining and discoloration on adjacent surfaces caused by work under this Section.

### 3.04 FIELD QUALITY CONTROL

- A. Maintain accessibility to all areas of work until completion of inspection by the Building Official (if required).

END OF SECTION 07 84 10

## SECTION 07 92 00 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.01 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work specified in this section.

#### 1.02 SUMMARY

- A. Section Includes: Provide sealant and backing materials for sealing of joints in construction. In general this includes, but not limited to, the following:
  - 1. Perimeter joints between exterior abutting materials and door frames, aluminum storefronts, windows, louvers, etc.
  - 2. Perimeter joints between interior wall surfaces and frames of doors, windows, etc.
  - 3. Perimeter joints of toilet fixtures.
  - 4. All locations noted on drawings as “sealant” or “caulking”.

#### 1.03 SUBMITTALS

- A. General: Make submittals in accordance with Section 013000.
- B. Product Data: Submit manufacturer’s technical data for each joint sealer product required, including instructions for joint preparation, primer (if required), and recommended back-up material.
- C. Samples for Initial Color Selection Purposes: Submit samples in form of manufacturer’s bead samples consisting of strips of actual products showing full range of colors available for each product exposed to view. Architect’s color selection shall not be limited to standard colors.
- D. Samples for Verification Purposes: Submit cured strips samples, 6 inches long, of each color and type of material proposed for use.
- E. Certification: Submit written certification from sealant manufacturer stating that materials forming joint substrates and joint backings have been tested for compatibility and adhesion with proposed joint sealants and are suitable for the use intended; certification shall state that proposed sealant has been tested for non-staining characteristics when applied to concrete and masonry. Include recommendations for primers and substrate preparation needed to obtain adhesion.
- F. Warranty Draft: Submit draft of warranties with required inclusions. Submit draft warranty with product data.
- G. Contract Closeout Submittal: Submit executed warranties at time of Project Closeout; include in “Warranties Manual” specified in Section 01 79 10.

#### 1.04 QUALITY ASSURANCE

- A. Installer’s Qualifications: Engage experienced Installers who have completed joint sealant applications similar in material, design, and extent to that indicated for Project.

- B. Single Source Responsibility: Obtain joint sealant materials from a single manufacturer for each different product required.
- C. Preconstruction Compatibility and Adhesion Testing: Prior to installation of joint sealants, field test their adhesion to joint substrates of each type encountered, and determine if priming and other specific joint preparation techniques are required. Perform tests under normal environmental conditions that will exist during actual installation. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.

#### 1.05 DELIVERY, HANDLING & STORAGE

- A. General: Comply with requirements specified in Section 01 60 00.
- B. 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.
- C. Store and handle in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### 1.06 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
  - 1. Ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 degrees F.
  - 2. Joint substrates are wet due to rain, condensation or other causes.
- B. Joint Width Conditions: Do not proceed with installation of joint sealant when 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.

#### 1.07 WARRANTY

- A. Special Warranty: Warrant exterior sealant joints jointly and severally by the sealant manufacturer and sealant Installer against defects of materials and workmanship for a period of ten (10) years from date of Substantial Completion.
  - 1. Warranty shall include adhesive or cohesive failure of joints, and chalking or visible color change on surfaces of cured sealant for the full warranty period.

### PART 2 - PRODUCTS

#### 2.01 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: Unless otherwise specified, match color of adjacent material occurring in same plane. Where joints occur adjacent to two or more material colors in same plane, match color of

lighter adjacent material, unless otherwise directed. Custom colors for exposed sealants may be required if standard colors are not acceptable to the Architect.

## 2.02 SEALANT TYPES AND MANUFACTURERS

- A. Type "A" Sealant: Single component, latex sealant complying with requirements of ASTM C834, Type P, Grade NF. Sealants shall be of the following types, or approved equal:
  - 1. Tremco Corporation "Tremflex 834".
  - 2. Pecora Corporation "AC-20 Acrylic Latex".
  - 3. Sonneborn Building Products "Sonolac".
  
- B. Type "B" Sealant: Single component, mildew resistant silicone sealant complying with requirements of ASTM C920, Type S, Grade NS, Class 25. Color white. Sealants shall be of the following types, or approved equal:
  - 1. Dow Corning "786 Mildew Resistant Silicone".
  - 2. General Electric "SCS1702".
  - 3. Pecora Corporation "898 Silicone Sanitary Sealant".

## 2.03 SEALANT MATERIALS

- A. Joint Backing: Preformed compressible, resilient, non-waxing, non-extruding foam, of size, shape and density to suit various conditions and control sealant depth. Provide open or closed cell as recommended by sealant manufacturer.
  - 1. Backer rod type recommended for compatible with sealant by sealant manufacturer, and of type which does not cause staining or discoloration of joint based on field experience and laboratory testing.
  - 2. Sizes as recommended by sealant manufacturer, with diameter never less than 30 percent greater than width of joint.
  
- B. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing bond between sealant and back surface of joint. Provide self-adhesive tape wherever applicable.
  
- C. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated.
  
- D. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.

## PART 3 - EXECUTION

### 3.01 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 joint sealer work until unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. **Cleaning of Joints:** Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturers written instructions and the following requirements:
  - 1. Clean joint surfaces free from dirt, dust, and any other contaminants that could interfere with adhesion of joint sealant.
  - 2. Clean porous joint substrate surfaces by brushing or mechanical abrading to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Remove laitance and form release agents from concrete.
  - 3. Clean 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. **Jointing Priming:** Prime joint substrates where recommended by joint sealer manufacturer based on preconstruction compatibility and adhesion testing or prior experience. Apply primer undiluted in uniform coating over surface. Confine primers to areas of joint sealer bond; do not allow spillage or migration onto adjoining surfaces.
- C. **Masking Tape:** Apply masking tape around joints where required to prevent contact of sealant with adjoining surfaces which otherwise would be stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.03 SEALANT APPLICATION

- A. **General:** Comply with joint sealer manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. **Installation Standards:** Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated.
- C. **Installation of Sealant Backings:**
  - 1. Install backer rods in all butt type joints receiving sealant where depth of joint exceeds manufacturer's recommendations. Install joint filler using a blunt tool or plain faced roller. Do not puncture, stretch, or twist joint fillers.
  - 2. Do not leave gaps between ends of joint fillers. Remove joint fillers that become wet prior to sealant application and replace with dry material.
  - 3. Generally, install joint fillers to a depth of 1/4 inch below surface of joint. Where depth of joint is not sufficient to require joint filler, install bond breaker tape to cover full width and length of joint cavity to prevent three sided adhesion.
- D. **Joint Width:** Width-to-depth ratio of sealant as recommended by sealant manufacturer. Do not exceed a depth of 1/2 inch when joint is 1/2 inch wide; joints exceeding 1/2 inch in width shall not exceed 1/4 inch in depth.
- E. **Mixing:** Mix two component sealant in accordance with manufacturer's directions using premeasured units. Do not thin or adulterate sealant in any way.
- F. **Installation of Sealants:** Apply sealant over backing to uniform thickness in continuous beads, filling all joints and voids solid; superficial pointing with skim bead will not be accepted. Use

nozzle of proper size to completely fill the joints. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- G. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads, free of air pockets; ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint.
  - 1. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.
  - 2. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- H. Pourable sealants shall be applied by gun or by pouring, filling the joint completely with a slight recessed finish. Additional material shall be added if low spots develop. Seal along outside slab edges of joints to prevent water from entering cavity formed by backer rod.

#### 3.04 PROTECTION AND CLEANING

- A. Protection: Protect joint sealers 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 sealers immediately and reseal joint with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.
- B. Clean-Up: Upon completion, remove and dispose of masking materials; remove all excess sealing materials; clean adjacent surfaces of all soil and stain resulting from sealing operations.

#### 3.05 SEALANT SCHEDULE

- A. General: The various types of sealants shall be used in the following locations:
- B. Type "D": All interior joints in a vertical plane, except in wet areas.
- C. Type "E": All interior joints in a vertical plane in wet areas such as toilet and shower areas.

END OF SECTION 07 92 00

SECTION 08 11 00 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 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.

1.02 DESCRIPTION OF WORK

- A. Extent of standard steel doors and frames is shown on the drawings. Include galvanized steel doors and frames where indicated.
- B. Finish hardware is specified elsewhere in Division 8.

1.03 QUALITY ASSURANCE

- A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.
- B. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows," and have been tested, listed and labeled in accordance with ASTM E 152 "Standard Methods of Fire Tests of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

1.04 CODES AND STANDARDS

- A. All fire-rated doors shall be tested in accordance with and provide features which comply with Section 714 of the International Building Code and shall be labeled in accordance with IBC Section 714.2.5.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements.
- B. Shop Drawings: Submit for fabrication and installation of 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 finish 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 coordination of glazing frames and stops with glass and glazing requirements.
  - 3. Provide details of conduit and preparations for power, signal and control systems.
- C. Label Construction Certification: For door assemblies required to be fire-rated and exceeding sizes of tested 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.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory-finished doors.
- B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided finish 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" 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" spaces between stacked doors to promote air circulation.

#### 1.07 SPECIAL WARRANTY

- A. Provide 10-year warranty for exterior doors (copy of warranty terms bound herein).

### PART 2 - PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide steel doors and frames by one of the following:
  - 1. Steel Doors and Frames, (General):
    - a. Amweld /Div. American Welding and Mfg. Co.
    - b. Ceco Corp.
    - c. Curries Mfg., Inc.
    - d. Fleming.
    - e. Republic Builders Prod. Corp./Subs. Republic Steel.
    - f. Steelcraft/Div. American Standard Co.

#### 2.02 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 (Zinc-Coated) Steel: Commercial quality with 0.20% copper, ASTM A 526, G90 hot-dip galvanized; mill-phosphatized for painted finish (and fully factory-primed, all surfaces).
- D. Supports and Anchors: Fabricate of not less than 18 gage galvanized sheet steel.
- E. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into walls, complying with ASTM A 153, Class C or D as applicable.
- F. Shop Applied Paint:



1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

## 2.03 FABRICATION, GENERAL

- 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 SDI-100 requirements as follows:
  1. Interior Doors: SDI-100, Grade II, heavy-duty, Model 1, minimum 18-gage faces, A60 galvanized steel.
  2. Exterior Doors and Corresponding Vestibule Doors (if any): SDI-100, Grade III, extra heavy-duty, Model 2A, minimum 14-gage faces, A60 galvanized steel.
- B. Core: Use synthetic resin sound deadening cores, impregnated synthetic kraft honeycomb cores - or manufacturer's standard foam cores.
- C. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel.
- D. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at fabricator's option).
- E. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.
- F. Finish Hardware Preparation: Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.
  1. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
  2. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware," published by Door and Hardware Institute. Note special hardware mounting heights at glazed building entry doors where indicated on drawings.
- G. Shop Painting:
  1. Clean, treat, and paint exposed surfaces of steel door and frame units.
  2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint. Treat or etch galvanized frames to ensure paint bond.
  3. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

## 2.04 STANDARD STEEL DOORS

- A. Provide metal doors of types and styles indicated on drawings or schedules. Provide transom panels of matching construction where scheduled.

- B. Electrical Doors: For doors indicated to receive electrified hardware, provide factory installed conduit or wiring harness and quick connectors to accept electrified wiring (wiring not included).

## 2.05 STANDARD STEEL 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 interior frames of minimum 16-gage A60 galvanized steel  
Exterior frames: 14-gage A60 galvanized steel. Provide all glazing stops.
  - 1. Fabricate frames with mitered and welded corners.
- B. Electrified Frames: For frames indicated to receive electrified hardware, provide frames with factory installed conduit and j-box to receive electrified wiring (wiring not included).
- C. Door Silencers: Except on weatherstripped frames, drill stops to receive 2 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames. Provide all silencers.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings and 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 in-place concrete or masonry and at 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. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices. Dimple frame, plug weld and grind smooth.
  - 3. Install fire-rated frames in accordance with NFPA Std. No. 80.
  - 4. In metal stud partitions, install one floor anchor and at least 3 wall anchors per jamb at hinge and strike levels. In open steel stud partitions, place studs in wall anchor notches and wire tie. In closed steel stud partitions, attach wall anchors to studs with tapping screws.
- C. Door Installation:
  - 1. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.
  - 2. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

### 3.02 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 finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating conditions.

END OF SECTION 08 11 00

## SECTION 08 21 10 - FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Extent and location of each type of flush wood door is indicated on drawings and in schedules.
- B. Types of doors required include the following:
  - 1. Factory finished solid core doors with Maple veneer faces.
- C. Factory-prefitting to frames and factory-premachining for hardware for wood doors is included in this section as Contractor's option.
- D. Louvers for flush wood doors, including furnishing and installation, are specified under this section.
- F. Metal door frames for flush wood doors are specified in another Division-8 section.

#### 1.03 SUBMITTALS

- A. Product Data: Door manufacturer's technical data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.
- B. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other pertinent data.
  - 1. For factory-premachined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light and louver openings.
- C. Samples: Submit samples, 1'-0" square or as indicated, for the following:
  - 1. Maple Veneer Doors: Door construction sample with face veneer.
  - 2. Metal Frames for Light Openings: Metal light frames in 6" lengths; for each material, type and finish required.

#### 1.04 QUALITY ASSURANCE

- A. Quality Standards: Comply with the following standards:
  - 1. WDMA Quality Standard: for grade of door, core construction, finish and other requirements.
- B. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152 and which are

labeled and listed for ratings indicated by UL, Warnock Hersey or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Oversize Fire-Rated Wood Doors: For door assemblies exceeding sizes of tested assemblies, provide manufacturer's certificate stating that doors conform to all standard construction requirements of tested and labeled fire door assemblies except as to size.

- C. Manufacturer: Obtain doors from a single manufacturer.

#### 1.05 CODES AND STANDARDS

- A. All fire-rated doors shall be tested in accordance with and provide features which comply with Section 714 of the International Building Code and shall be labeled in accordance with IBC Section 714.2.5.

#### 1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standards and recommendations of WDMA, as well as manufacturer's instructions. Make every effort to prevent doors from being exposed to moisture, or absorbing moisture in this project's pool environment.
- B. Identify each door with individual opening numbers which correlate with designation system used on shop drawings for door, frames, and hardware, using temporary, removable or concealed markings.

#### 1.07 PROJECT CONDITIONS

- A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to project's geographical location:
  1. Refer to WDMA quality standards for moisture content. Ensure that moisture content limits are maintained before, during and after installation.

#### 1.08 WARRANTY

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors which have warped (bow, cup or twist) or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards.
  1. Warranty shall be in effect during following period of time after date of Substantial Completion.
  2. Solid Core Interior Doors:
    - a. Life of installation.

- C. Contractor's Responsibilities: Replace or refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, including lifetime warranty provision, provide products of one of the following:
1. Eggers Industries, Architectural Door Division.
  2. Lynden Door Inc.
  3. Masonite Corp., Commercial Division.
  4. Timco Industries, Inc.
  5. VT Industries.
  6. Sauder Door Co., Inc.
  7. Western Oregon Door Co., Inc.
  8. Seattle Door Company.
  9. Vancouver Door Company.
  10. Weyerhaeuser Company.

### 2.02 WOOD VENEER-FACED DOORS

- A. Solid Core Doors for Stain and Varnish Finish: Comply with the following requirements:
1. Grade: A
  2. Wood Faces: Northern Hard Maple
  4. Exposed Vertical and Top Edges: Structural composite lumber
  5. Core: Structural composite lumber ore
  6. Construction: WDMA SCLC-5
  7. WDMA I.S.1A (current edition) Performance Grade: Extra Heavy duty.

### 2.03 LIGHT FRAMES

- A. Metal Frames for Light Openings in Fire Doors: Manufacturer's standard low profile frame formed of 18-gage cold-rolled steel, factory-primed, and approved for use in door of fire-rating indicated.

### 2.04 FABRICATION

- A. Fabricate flush wood doors to produce doors complying with following requirements:
1. In sizes indicated for job-site fitting.
  2. Factory-prefit and premachine doors to fit frame opening sizes indicated with the following uniform clearances and bevels:
    - a. Comply with tolerance requirements of WDMA for prefitting. Comply with final hardware schedules and door frame shop drawings and with hardware templates.
    - b. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory premachining.

- B. Metal Astragals: Premachine astragals and formed steel edges for hardware where required for pairs of fire-rated doors.
- C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of doors required.
  - 1. Light Openings: Trim openings for non-fire-rated doors with solid wood moldings of low profile type.

## 2.05 FACTORY FINISHING

- A. General: For transparent finish wood doors, perform finishing operation at the factory in compliance with referenced AWI quality standard including Section 1500 "Factory Finishing".
- B. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect and sheen.
  - 1. AWI Grade: Premium.
  - 2. Finish: Manufacturer's standard finish with performance requirements comparable to either AWI System TR-4 conversion varnish or AWI System TR-6 catalyzed polyurethane or equivalent WDMA-recommended finish for moist environment.
  - 3. Staining: Match Architect's sample.
  - 4. Effect: Open grain finish.
  - 5. Effect: Filled finish.
  - 6. Sheen: Satin medium rubbed effect.
- C. NOTE: Ensure that all surfaces, edges and cut-outs are finished/sealed to prevent post-finish moisture absorption. These door will be used in a pool-facility environment, and every effort must be undertaken remote from the project site to prevent moisture absorption by wood doors once delivered thereto.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine installed door frames prior to hanging door:
  - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
  - 2. Reject doors with defects.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Hardware: For installation see Division-8 "Finish Hardware" section of these specifications.
- B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames in accordance with requirements of NFPA No. 80.
- C. Job Fit 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. Fitting Clearances for non-rated doors: Provide 1/8" at jambs and heads; 1/16" per leaf at meeting stiles for pairs of doors; and 1/8" from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4" clearance from bottom of door to top of threshold.
  2. Fitting Clearances for Fire Rated Doors: Comply with NFPA 80.
  3. Bevel non-rated doors 1/8" in 2" at lock and hinge edges.
  4. Bevel fire-rated doors 1/8" in 2" in lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Prefit Doors: Fit to frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at the job site.

3.03 ADJUST AND PROTECTION

- A. Operation: Rehang or replace doors which do not swing or operate freely.
- B. Finished Doors: Refinish or replace doors damaged during installation, as directed by Architect.
- C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 08 21 10



## SECTION 08 71 00 - DOOR HARDWARE

### PART 1 - GENERAL

#### 1.01 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.

#### 1.02 SUMMARY

- A. Work covered by this section of the specifications consists of furnishing and delivering to the job site for fitting and installation, all finish hardware complete, in accordance with this section and applicable drawings. It is intended that the following list of hardware will cover all finish hardware to complete the project. Omissions and discrepancies shall be brought to the Architect's attention during the bidding period. Hardware for labeled openings shall meet U.L. requirements.

- B. Types of finish hardware include the following:

1. Hinges
2. Lock cylinders and keys
3. Lock and latch sets
4. Exit devices
5. Closers
6. Overhead holders and stops
7. Miscellaneous door control devices
8. Weatherstripping
9. Door bottoms
10. Kickplates and door protection
11. Silencers
12. Electric strikes

#### 1.03 REFERENCES

- A. The following references shall be used to estimate, detail, schedule, furnish, and install finish hardware:

1. ANSI/ CABO A117.1: Assessable and Usable Buildings and Facilities.
2. ANSI/ BHMA A156.1 through A156.24: Product Standards for Builders Hardware.
3. NFPA 80: Fire Doors and Windows.
4. NFPA 101: Life Safety Code.
5. DHI: Hardware for Labeled Fire Doors.
6. DHI: Recommended Locations for Architectural Hardware for Standard Hollow Metal Doors and Frames.
7. DHI: Recommended Locations for Architectural Hardware for Custom Hollow Metal Doors and Frames.
8. DHI: Abbreviations and Symbols.

#### 1.04 SUBMITTALS

- A. All submittals shall be in accordance with Section 01300.
- B. Submit five (5) typewritten hardware schedules for approval. After approval, provide required number of copies of the approved hardware schedule for distribution to other trades.
- C. Submit schedules in accordance to DHI publication on Sequence and Format for the Hardware Schedule and include explanation of all abbreviations, symbols, and codes.
- D. Include cross-reference to hardware groups in the hardware schedule.
- E. Indicate type, style, function, size, hand, means of fastening and manufacturer for each hardware item.
- F. Mark openings with the Architect's numbering and indicate each door and frame: Locations, sizes, material, hand, degree of opening, and fire rating.
- G. Submit five (5) copies of catalog cuts for each hardware item listed in the schedule. Catalog cuts must be of good reliable quality. Highlight each cut to readily show compliance with the project's requirements.
- H. Provide samples if required by the Architect. Samples will be returned to be incorporated into the work.
- I. Furnish a complete and current set of templates to all other related material suppliers.
- J. Keying will be provided by the Owner.
- K. Detailed wiring diagrams and installation instructions shall be provided for all electrified hardware provided in this section.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturers and model numbers listed have been selected to establish a standard of quality for this project. Only approved manufacturers and model numbers will be accepted.
- B. Only recognized builders' hardware suppliers who have regularly engaged in furnishing hardware in the project vicinity for a minimum of two (2) years will be acceptable. This supplier must have in its employ an Architectural Hardware Consultant, who is available at reasonable times, during the course of the work for consultation about the project's hardware details, installation or adjustment. Suppliers without certified consultants may be required to furnish a letter of qualification, listing similar projects furnished, including the Architect's name, date and year, and the project's location.
- C. Provide hardware for fire rated openings in compliance with NFPA - 80 2007 edition.
- D. Products requiring electrical connections must be listed and classified by Underwriters Laboratories.

1.06 DELIVERY, HANDLING, AND STORAGE

- A. Hardware shall be delivered to the project site in the manufacturer's original packaging, marked with the door number it will be placed on.
- B. Jointly inventory the hardware upon delivery with the Contractor and/or Installer.
- C. Store all hardware in a clean, dry, and secure room to protect hardware from damage and loss.

1.07 WARRANTY

- A. Warranties shall be in accordance with Division 1, Sections 01780 - Product Warranties. The following items shall have warranty in excess of Sections 01780: Door Closers, 10 years; Mortise Locks and Latches, 5 years; Exit and Fire Exit Devices, 3 years. Warranty period shall begin from the date of substantial completion.

1.08 MAINTENANCE

- A. No maintenance contracts required for this project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The following firms have been selected as acceptable manufacturers of finish hardware for this project:

Hinges	McKinney	Stanley, Ives
Locksets	Schlage	
Cylinders	Schlage	
Exit Devices	Von Duprin	
Closers	LCN	
Wall / Floor Stops	Ives	
Gasketing	Pemko	National Guard
Kickplates/Protective Items	Ives	Rockwood
Electric Strike	Von Duprin	

2.02 MATERIALS

- A. The following products have been selected to establish a level of quality, design, and function. Furnish either the designated item or an approved alternate. Drawings show the direction of slide, swing, and hand of each door. Furnish each item of hardware for proper installation and operation. Check door and frame types to ensure all additional installation accessories are included with the specified item.

2.03 FASTENERS

- A. All screws shall be of matching finish to their product and shall be manufacturer's standard. Door closers, door holders, and exit devices installed on fire rated wood doors and hollow metal doors shall be attached with sex nuts and bolts. All door closers to be mounted on wood doors with sex nuts and bolts.

#### 2.04 HINGES AND PIVOTS

- A. Doors 1-3/4" thick minimum use 4-1/2" hinges.
- B. Each door shall have three (3) hinges. Doors 7'-6" in height and over shall have an additional hinge for each 30" of additional height, or fraction thereof.
- C. Exterior doors over 3'-2" wide and/or 7'-6" high shall have heavy weight hinges. Hinges shall be non-ferrous, non-removable stainless steel pins.
- D. Interior reverse bevel doors with lockable hardware shall have non-removable pin hinges.
- E. Hinges shall be sized in width to clear all trim.

#### 2.05 LOCKSETS

- A. Locks and trim shall be the product of one manufacturer.
- B. Functions are shown in hardware sets.
- C. Provide 3/4" minimum latch throw for mortise locks and 1" throw for deadbolts.
- D. Provide locks with 6-pin cylinder.

#### 2.06 DOOR CLOSERS

- A. Door closers shall be fully adjustable type with complete spring power adjustment, sizes 2 - 6 and field adjustable according to door size and frequency of use. Closer shall have adjustable back-check.
- B. Where closers are indicated to be delayed action, provide units with adjustable delay.
- C. Where doors are indicated to be accessible to the physically handicapped, provide units that comply with ANSI A117.1 provisions for door opening force and delayed action for closing.
- D. Provide all accessories for mounting required by door and frame types.

#### 2.07 EXIT DEVICES

- A. Except on fire rated doors, equip exit devices with a dogging feature to hold the push bar down and the latch bolt in the retracted position unless otherwise noted.
- B. Where exit devices are required on fire rated doors, provide devices with UL label indicating "Fire Exit Hardware". For doors without fire rating, provide devices listed for "Panic Hardware".

#### 2.08 DOOR TRIM UNITS

- A. Fabricate protection plates not more than 2" less than door width on stop side of door and not less than 1" less than door width on pull side of door.
- B. Metal plates shall be of stainless steel and .050 or 18 ga.

- C. Provide manufacturer's standard exposed fasteners with through bolting on matched pairs.

2.09 KICKPLATES

- A. Provide kickplates on push side of door.
- B. Provide kickplates on both leaves on pairs of doors.
- C. Provide stainless steel, full threaded type sheet metal screws for fastening not more than 5" o.c.

2.10 ELECTRIC STRIKES

- A. ANSI A156.5 mortised electric strikes.

2.12 ACCESSORIES

- A. Lock Trim: Furnish levers with escutcheon plate as indicated in Schedule as selected from manufacturer's full range of levers and roses.
  - 1. Do not permit through bolts on solid wood core doors.
- B. Through Bolts: Do not permit through bolts and grommet nuts on door faces in occupied areas unless no alternative is possible.
  - 1. Do not use through bolts on solid wood core doors.

2.13 SILENCERS

- A. All interior frames shall have silencers. Three (3) per single door and two (2) per pair.

2.14 FINISHES

- A. The designations used in hardware sets indicate hardware finishes are to be industry recognized standard commercial finishes established by BHMA.

Hinges	652
Locks	626
Closers	689
Exit Devices	626
Door Stops	626

2.15 KEYING

- A. Permanent cylinders / keying provided by Owner.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount hardware units at heights indicated in “Recommended Locations for Builders Hardware for Standard Steel Doors and Frames”, by DHI. The local authority having jurisdiction may have specific requirements that may apply.
- B. Vision Panels: Mounting is custom. Panic hardware is to be mounted to clear vision panel frames. The vision panel is to be located 43 inches maximum off finished floor, governed by ADA regulations.
- C. Install each hardware item in compliance with manufacturer instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections.
- D. Set all hardware plumb and true to locations specified in the installation instructions.
- E. Set thresholds for exterior doors in a bed of butyl-rubber sealant.
- F. Upon completion of installation, verify hardware has been installed in accordance with the approved finish hardware schedule. Check hardware for proper placement and operation. Hardware found to be incorrectly installed or damaged will be repaired or replaced.
- G. Return to work one week prior to acceptance of occupancy and make final check and adjustment of all hardware. 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 air conditioning and ventilating equipment. Hardware to be found defective shall be repaired or replaced.
- H. Instruct Owner’s personnel in proper adjustment and maintenance of hardware and finishes during the final adjustment period.
- I. Approximately six months after the acceptance of hardware in each area, the installer, accompanied by a representative of the latch and lock manufacturer, shall return to the project and adjust every hardware item to restore intended function and performance. Consult with Maintenance personnel with additional requirements of maintenance procedures. Replace all hardware items that have failed due to design, materials, and/or installation problems. Prepare a written report of current and future problems observed during this inspection.

3.02 SCHEDULE

**Hardware Set 01**

Doors: 102

Each to Receive:

1	EA Hinge	TA2714 4.5 x 4.5 - CC4	652	MK
1	EA EL Conv. Kit	050070	626	VD
1	EA Power Supply	PS873FA-2		VD

Remaining hardware to be re-used. Access control by others.

**Hardware Set 02**

Doors: 105

Each to Receive:

6	EA Hinge	T4A3786 4.5 x 4.5 NRP	652	MK
1	EA Exit Device	9927EO-F	626	VD

1	EA Exit Device	9975L -F x 996L-M	626	VD
2	EA Bracket	MB	600	IV
1	EA Bracket	MBF	600	IV
1	EA Coordinator	COR x FL	600	IV
2	EA Closer	4040XP-EDA	689	LC
2	EA Kick Plate	8400- 10" x 2" LDW	630	IV
2	EA Wall Stop	WS401CCV	626	IV
1	EA Gasket	S88D	Bronze	PE
2	EA Meeting Stile	18041CNB	628	PE

**Hardware Set 03**

Doors: 106A

Each to Receive:

5	EA Hinge	T4A3786 4.5 x 4.5 NRP	652	MK
1	EA Hinge	T4A3786 4.5 x 4.5 - CC4	652	MK
1	EA Exit Device	EL9975L-NL x 996L-NL-M	626	VD
1	EA Exit Device	9927 EO	626	VD
2	EA Bracket	MB	600	IV
1	EA Bracket	MBF	600	IV
1	EA Coordinator	COR x FL	600	IV
2	EA Closer	4040XP-EDA	689	LC
2	EA Kick Plate	8400- 10" x 2" LDW	630	IV
2	EA Wall Stop	WS401CCV	626	IV
1	EA Gasket	S88D	Bronze	PE
2	EA Meeting Stile	18041CNB	628	PE
1	EA Power Supply	PS873-2		VD

Access control by others.

**Hardware Set 04**

Doors: 106B

Each to Receive:

1	EA Electric Strike	6210	630	VD
1	EA Kick Plate	8400- 10" x 2" LDW	630	IV

Remaining hardware to be re-used. Access control by others.

**Hardware Set 05**

Doors: 112, 113, 114, 119

Each to Receive:

3	EA Hinge	TA2714 4.5 x 4.5	652	MK
1	EA Office	L9050L 06N	626	SC
1	EA Wall Stop	WS401CCV	626	IV
3	EA Silencer	SR64	Grey	IV

**Hardware Set 06**

Doors: 111

Each to Receive:

3	EA Hinge	TA2714 4.5 x 4.5	652	MK
1	EA Storeroom	L9080L 06N	626	SC
1	EA Electric Strike	6210	630	VD

1	EA Closer	4040XP	689	LC
1	EA Kick Plate	8400- 10" x 2" LDW	630	IV
1	EA Wall Stop	WS401CCV	626	IV
3	EA Silencer	SR64	Grey	IV

Access control by others.

**Hardware Set 07**

Doors: 107, 108, 109, 115, 117

All hardware to be re-used.

END OF SECTION 08 71 00



## SECTION 08 80 00 - GLASS AND GLAZING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section Includes: Glass and glazing materials indicated for interior openings where indicated on drawings. Glazing schedule at end of this Section. Types of work in this Section include, but are not limited to, glass and glazing for:
  - 1. Glazing of interior wood and metal doors, and relite/sidelite frames.
  - 2. Glass and glazing materials (glazing tapes, gaskets, setting blocks, sealants).
- B. Related Sections:
  - 1. Section 08 21 10 - Wood Doors: Vision panels.
- C. Substitutions: Refer to Section 01 63 00.

#### 1.03 SUBMITTALS

- A. General: Make submittals in accordance with Section 01330. Submittals specified in this Section shall be incorporated into submittals specified in other Sections, where glass is to be provided in those Sections.
- B. Product Data: Submit manufacturer's technical data for each glazing material and fabricated glass product.
- C. Glazing Instructions: Submit detailed instructions for the installation of glass. Instructions and explanatory details shall include the following:
  - 1. Sequence of installation, including cleaning procedures and priming (if required).
  - 2. Method of installation, including list of glazing materials.
  - 3. Location of specific items, such as the setting blocks and any special instructions as may be required.
- D. Certifications from Glass Manufacturers: Submit certificates from respective manufacturer's attesting that glass and glazing materials furnished for Project complies with specified requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass.
- E. Warranty Draft: Submit draft of warranty with required inclusions for review. Submit draft warranty with glass analysis.
- F. Contract Closeout Submittal: Include the following at time of Project Closeout:
  - 1. Submit executed warranties; include in "Warranties Manual" specified in Section 01 74 00.

#### 1.04 QUALITY ASSURANCE

- A. Glaziers 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.
- B. 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. Glass Association of North America (GANA): "Glazing Manual".
- C. Safety Glazing Standard: Products complying with American National Standards Institute (ANSI) Z97.1 and testing requirements of Consumer Products Safety Commission (CPSC) 16 CFR Part 1201 for Category II materials. Provide safety glass permanently marked.
- D. Allowable Tolerances: Perimeter glass clearances within the setting frame (face clearances, edge clearances, and nominal bite) shall be as required by the aluminum window and entrance framing manufacturers.
- E. Labeling:
  - 1. Tempered, Heat-Strengthened, and Laminated Glass: Each piece shall bear manufacturer's labeling stating manufacturer and quality.

#### 1.05 DELIVERY, STORAGE & HANDLING

- A. General: Comply with requirements specified in Section 01600.
- B. Do not deliver glass to site until areas to be glazed are ready to receive glass and job conditions are satisfactory. Deliver glass in manufacturer's storage cases with interleaving between lights. Provide cushions at edges of glass to prevent impact damage during shipment and storage.
  - 1. Do not unpack glass until needed for installation.
  - 2. Handle and install materials in a manner to prevent breakage, edge damage, scratching or other damage. Keep vacuum cups free from foreign material that could scratch glass.
- C. Comply with insulating unit Fabricator's requirements for limits on exposure to reduced barometric pressure during shipment.

#### 1.06 PROJECT CONDITIONS

- A. Verification of Measurements: Before fabrication, verify all measurements to ensure proper fit. Sizes shown on drawings are for estimating purposes only. Allow sufficient time for taking accurate field dimensions so that fabrication and installation are within construction schedule.
- B. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes. Do not proceed

with installation of glazing sealants when the ambient temperature conditions are below 40 degrees F.

- C. Protection: Do not mark glass surfaces with crayons or other marking pencils. Where warnings are required, fasten tapes or banners to head framing. Provide masking or other shielding for glass when performing welding or other construction work adjacent to installed glazing; replace all glass damaged due to construction operations.

#### 1.07 WARRANTIES

- A. General: Replace all installed units which fail under use with new conforming units. Replacement shall include coordination with Owner, immediate provision for maintaining openings secure and weathertight, timely ordering and fabrication of replacement items as required, installation, and cleaning. Warranty does not cover failure due to vandalism or glass breakage caused by external projectiles.
- B. Special Warranty on Glass Breakage: Warrant glass units jointly and severally, on a single document, by the Installer and Contractor, agreeing to replace all glass units broken by temperature changes, flaws in materials, environmental conditions (excluding fire and impact), and normal deflection up to specified limits for a period of five (5) years from date of Substantial Completion.
  - 1. No allowances for statistical probability of breakage under anticipated loading conditions will be made in consideration of failure of glass materials under load.
  - 2. This warranty shall include all labor and materials for replacement of failed unit(s).

### PART 2 - PRODUCTS

#### 2.01 GLASS PRODUCTS, GENERAL

- A. Primary Glass Standard: Provide primary glass which complies with FS DD-G-451 requirements, including those indicated by reference to type, class, quality, and form.
- B. Heat-treated Glass Standard: Provide heat-treated glass which complies with FS-G-1403 requirements, including those indicated by reference to grade, style, type, quality, and class.
- C. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer.

#### 2.02 PRIMARY GLASS PRODUCTS

- A. Clear Float Glass: Type I, class 1 (transparent), quality q3, (glazing select).

#### 2.03 HEAT-TREATED & PROCESSED GLASS PRODUCTS

- A. Manufacturing Process: Manufacture heat-treated glass as follows:
  - 1. By vertical (tong-held) or horizontal (roller health) process, at manufacturer's option, except provide horizontal process where indicated as "tongless" or "free of tong marks".

- B. Clear Tempered Float Glass: Grade B (fully tempered), style I (uncoated surfaces), type I (float), quality q3 (glazing quality), class 1 (transparent).
  - 1. Provide heat-treated coated float glass. Exceptions: provide heat-strengthened units where recommended by manufacturer for application indicated, and tempered where safety glass is designed or required by regulation.
- C. Fire-Rated Glass: NT by Technical Glass Products, or approved equal.

#### 2.04 GLAZING SEALANTS

- A. General: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants which have performance characteristics suitable for applications indicated and conditions at time of installation.
- B. Compatibility: Select sealants with proven compatibility with surfaces contacted in the installation and under service conditions indicated, as demonstrated by testing and field experience.
- C. Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
- D. Silicone Glazing Sealant: Single component elastomeric silicone sealant complying with FS TT-S-001543, Class A, non-sag; and with ASTM C 920, Type S, Grade NS, Class 25, Use G and, as applicable to use indicated, Uses A and O; and with the following requirements:
- E. Low-Modulus Silicone Glazing Sealant: Manufacturer's standard low-modulus non-acid curing sealant that can withstand an increase and decrease of 50% of joint width as measured at time of application when tested per ASTM C 719.
- F. High-Modulus Silicone Glazing Sealant: Manufacturer's standard high-modulus acid-curing sealant.
- G. 2-Part Polysulfide Glazing Sealant: Polysulfide elastomeric sealant complying with FS TT-S-00227, Class A, Type 2; and with ASTM C 920, Type M, Grade NS, Class 25, Use G and, as applicable to use indicated, Uses A and O.
- H. Preformed Butyl-Polyisobutylene Glazing Tape: Blend of butyl- polyisobutylene rubber with a solids content of 100%, in extruded tape form, complying with AAMA 807.1, packaged on rolls with a release paper on side, with or without continuous spacer rod as recommended by manufacturers of tapes and glass for application indicated.

#### 2.05 GLAZING GASKETS

- A. Lock-Strip Gaskets: Neoprene extrusions of size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542; black.
- B. Dense Elastomeric Compression Seal Gaskets: Molded or extruded neoprene or EPDM gaskets or profile and hardness required to maintain watertight seal; complying with ASTM C 864, Option 1.
- C. Cellular Elastomeric Preformed Gaskets: Extruded or molded closed cell, integral-skinned neoprene of profile and hardness required to maintain watertight seal; complying with ASTM C 509, Type II; black.

## 2.06 GLASS FABRICATION

- A. General: 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.
- B. Edges: Provide factory-cutting and factory formed edges for all heat treated and insulating glass. Take care when cutting and forming edges of glass to furnish clean accurate edges.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. General: Prior to starting work, carefully inspect installed work of other trades and verify that work is complete to the point where work of this Section may properly commence. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions and responsibility for defective installation caused by prior observable conditions.

### 3.02 PREPARATION

- A. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates.

### 3.03 GLAZING, GENERAL

- A. Comply with combined printed recommendations of glass manufacturers, of manufacturer's of gaskets, sealants and other glazing materials, except where more stringent requirements are indicated, including those in GANA "Glazing Manual" and SIGMA.
- B. Glazing channel dimensions as indicated in details are intended to provide for necessary bite on glass, minimum edge and face clearances, with reasonable tolerances. Adjust as required by job conditions at time of installation.
- C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Remove from Project and dispose of glass units with edge damage or other imperfections.

### 3.04 GLAZING

- A. Set glass tightly in position with proper clearances in accordance with referenced standards. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- B. Glazing in Hollow Metal Doors and Sidelights and Wood Doors: Set glass in glazing tape against fixed stops. Install tape with tight butt joints; no overlaps will be accepted. Position glass, uniformly sealing against tape. Install removable stops and place tape in stops forming a uniform seal against glass and level, clean sight lines.

3.05 PROTECTION AND CLEANING

- A. Protect glass from contact with contaminating substances resulting from construction operations. If contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.
- B. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

PART 4 - GLASS SCHEDULE

4.01 GLAZING TYPES

- A. Type A: Single sheet tempered or laminated safety glass, clear, 1/4" thick.
- B. Type B: Firelite NT by Technical Glass Products, or approved equal.

4.02 GLAZING TYPE LOCATIONS

- A. Furnish types as shown on drawings and, where not shown, as follows:
  - 1. Type A: Interior: At all door and relite glazing locations.
  - 2. Type B: At interior door and relite locations where glazing is a component of fire-rated doors or walls having fire-rated door openings. See Door and Relite Schedules for exceptions (if any).

END OF SECTION 08 80 00

SECTION 09 25 00 - GYPSUM DRYWALL

PART 1 - GENERAL

1.01 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.

1.02 DESCRIPTION OF WORK

- A. Types of work include:
  - 1. Gypsum drywall including screw-type metal support system.
  - 2. Drywall finishing (joint tape-and-compound treatment).
  - 3. Structural steel studs at raised floor.
- B. Related Work: Joint Sealants, 07 92 00, for sealants at acoustical wall penetrations.

1.03 QUALITY ASSURANCE

- A. Fire-Resistance Rating: Where gypsum drywall systems with fire-resistance ratings are indicated, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories acceptable to authorities having jurisdiction.
  - 1. Provide fire-resistance rated assemblies identical to those indicated by reference to GA File Numbers, in GA "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in listing of other testing and agencies acceptable to authorities having jurisdiction. Include tent protection of lighting fixtures per U.L. Design.
- B. Gypsum Board Terminology Standard: GA-505 by Gypsum Association.
- C. Single-Source Responsibility: Obtain gypsum board products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications and installation instructions for each gypsum drywall component, including other data as may be required to show compliance with these specifications.

1.05 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 in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging. Do not overstress floor structure with excessive stockpiling.

- C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

#### 1.06 PROJECT CONDITIONS

- A. Environmental Requirements, General: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.
- B. Cold Weather Protection: When ambient outdoor temperatures are below 55 deg F (13 deg C) maintain continuous, uniform, comfortable building working temperatures of not less than 55 deg F (13 deg C) for a minimum period of 48 hours prior to, during and following application of gypsum board and joint treatment materials or bonding of adhesives.
- C. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

### PART 2 - PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
  - 1. Metal Support Materials:
    - a. Allied Structural Industries.
    - b. Bostwick Steel Framing Co.
    - c. Dale Industries, Inc.
    - d. Gold Bond Building Products Div., National Gypsum Co.
    - e. Milcor Division; Inryco Inc.
    - f. Marino Industries.
    - g. United States Gypsum Co.
  - 2. Gypsum Board and Related Products:
    - a. Domtar Gypsum America, Inc.
    - b. Georgia-Pacific Corp.
    - c. Gold Bond Building Products Div., National Gypsum Co.
    - d. United States Gypsum Co.

#### 2.02 METAL SUPPORT MATERIALS

- A. Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, hat-shaped.
  - 1. Where shown as "Resilient", provide manufacturer's special type designed to reduce sound transmission.
- B. Fasteners for Furring Members: Type and size recommended by furring manufacturer for the substrate and application indicated.



## 2.03 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 and ASTM C 645 under the following conditions:
    - a. 2-1/2" studs at 12" o.c.:
      - 1) 25 gage up to 13'-6" high
      - 2) 20 gage up to 15'-4" high
    - b. 3-1/2" studs at 16" o.c.:
      - 1) 25 gage up to 16'-0" high
      - 2) 20 gage up to 18'-6" high
      - 3) 16 gage up to 20'-0" high
    - c. 6" studs at 16" o.c.:
      - 1) 25 gage up to 23'-0" high
      - 2) 20 gage up to 27'-0" high
      - 3) 16 gage up to 29'-0" high
    - d. 8" studs at 16" o.c.:
      - 1) 25 gage up to 28'-0" high
      - 2) 20 gage up to 32'-0" high
      - 3) 16 gage up to 36'-0" high
  - B. Protective Coating: G40 hot-dip galvanized coating per ASTM A 525.
  - C. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90° and doubled over to form 3/16-inch-wide minimum lip (return).
  - D. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:
    1. Depth: as shown on Drawings.
    2. Thickness: 0.0179 inch, unless otherwise indicated.
  - E. Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, minimum thickness of base (uncoated) metal of 0.0329 inch, designed for screw attachment to steel studs and steel rigid furring channels used for furring.

## 2.04 STEEL FRAMING FOR FLOORS:

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0359 inch (0.84 mm).

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

- 1. Minimum Base-Metal Thickness: Matching steel studs.

#### 2.05 GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 36, of types, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.

- 1. Type: Type X.
  - 2. Edges: Tapered.
  - 3. Thickness: 5/8".

#### 2.06 TRIM ACCESSORIES

- A. General: Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf- type edge trim-beads, and one-piece control joint beads.

#### 2.07 JOINT TREATMENT MATERIALS

- A. General: ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.

- 1. Joint Tape: Paper reinforcing tape.
  - 2. Joint Compound: Ready-mixed vinyl-type for interior use.
    - a. Grade: 2 separate grades; one specifically for bedding tapes and filling depressions, and one for topping and sanding.

- B. Water-Resistant Joint Compound: Special water-resistant type for treatment of joints, fastener heads and cut edges of water-resistant backing board.

- 1. Product: Subject to compliance with requirements provide Sheetrock Brand W/R Compound; United States Gypsum Co.

#### 2.07 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.

- B. Gypsum Board Screws: Comply with ASTM C 646.

- C. Sound Attenuation Blanket Insulation: 3-1/2" thick R-11 mineral fiber batt insulation; unfaced.

- D. Concealed Acoustical Sealant: Nondrying, nonhardening, non-skinning, nonstaining, non-bleeding, gunnable sealant for concealed applications per ASTM C 920. Grade NS, Class 12-1/2, Uses M and A, single component.

- E. Exposed Acoustical Sealant: Nonoxidizing, skinnable, paintable, gunnable sealant for exposed applications per ASTM C 919.

### PART 3 - EXECUTION

#### 3.01 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.

#### 3.02 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.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation well in advance of time needed for coordination with other construction.

#### 3.03 INSTALLING STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, 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.
- C. Isolate steel framing from building structure as needed to prevent transfer of loading imposed by structural movement.
  - 1. Where building structure abuts ceiling perimeter or penetrates ceiling.
  - 2. Where partition framing and wall furring abut structure except at floor.
    - a. Provide slip- or cushioned-type joints as needed to attain lateral support and avoid axial loading.
- D. Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

#### 3.04 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

- A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.

1. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Cut studs 1/2 inch short of full height. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
  1. For STC-rated and fire-resistive-rated partitions requiring partitions to extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.
- D. Terminate partition framing at suspended ceilings where indicated.
- E. Install steel studs and furring in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard to comply with maximum deflection and minimum loading requirements specified:
  1. Single- and Double-Layer Construction: Space studs at 16 inches o.c.
- F. Install steel studs so that flanges point in the same direction and so that leading edges or ends of each gypsum board can be attached to open (unsupported) edges of stud flanges first.
- G. For curved partitions install steel framing as follows:
  1. Cut top and bottom runners through leg and web at 2-inch intervals for arc length. In cutting lengths of runners allow for uncut straight lengths of not less than 12 inches at ends of arcs.
  2. Bend runners to uniform curve of radius indicated and locate straight lengths so they are tangent to arcs.
  3. Support outside (cut) leg of runners by clinching a 1-inch-high by 0.0209-inch (25-gage)-thick sheet steel strip to inside of cut legs using metal lock fasteners.
  4. Attach runners to structural elements at floor and ceiling with fasteners located 2 inches from ends and spaced 24 inches o.c.
  5. Attach runners to suspended ceilings with toggle bolts or hollow wall anchors located 2 inches from ends and spaced 16 inches o.c. in between where attached to suspended ceilings.
  6. Position studs vertically with open sides facing in same direction and engaging floor and ceiling runners. Begin and end each arc with a stud and space intermediate studs equally along arcs at stud spacing recommended by gypsum board manufacturer for radiuses indicated. Attach studs to runners with 3/8-inch-long pan head framing screws. On straight lengths at ends of arcs, place studs 6 inches o.c. with last stud left free standing.
- H. Frame door openings to comply with details indicated, with GA-219, and with applicable published recommendations of gypsum board manufacturer. Jamb studs shall be 20 ga. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips

on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- I. Frame openings other than door openings to comply with details indicated or, if none indicated, in same manner as required for door openings. Install framing below sills of openings to match framing required above door heads.

### 3.05 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA 216.
- B. Install sound attenuation blankets as indicated, prior to gypsum board unless readily installed after board has been installed.
- C. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate courses of board.
- D. Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 1'-0".
- E. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
- F. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.
- G. Locate either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
- H. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
- I. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.
- J. Cover both faces of stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are braced internally.
  1. Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area, and may be limited to not less than 75% of full coverage.
- K. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant.

- L. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

### 3.06 METHODS OF GYPSUM DRYWALL APPLICATION

- A. Single-Layer Application: Install gypsum wallboard.
  - 1. On ceilings apply gypsum board prior to wall/partition board application to the greatest extent possible. Include tent protection of lighting fixtures per U.L. Design.
  - 2. On partitions/walls apply gypsum board vertically (parallel), unless otherwise indicated, and provide sheet lengths which will minimize end joints.
  - 3. On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular); use maximum length sheets possible to minimize end joints.
  - 4. On furring members apply gypsum board vertically (parallel) with no end joints. Locate edge joints over furring members.
- B. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:
  - 1. Fasten with screws.
- C. Double-Layer Fastening Methods: Apply base layer of gypsum board and face layer to base layer as follows:
  - 1. Fasten both base layers and face layers separately to supports with screws.
- D. Direct-Bonding to Substrate: Where gypsum board is indicated to be 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 board until fastening adhesive has set.

### 3.07 INSTALLATION OF DRYWALL TRIM ACCESSORIES

- A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.
  - 1. Install metal corner beads at external corners of drywall work.
  - 2. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).
  - 3. Install metal control joint (beaded-type) as recommended by USG Corporation but no less than 30'-0" o.c. Consult architect for detailed location instructions.

### 3.08 FINISHING OF DRYWALL

- A. General: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to

prepare work for decoration. Prefill open joints and rounded or beveled edges, if any, using type of compound recommended by manufacturer.

- B. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.
- C. Apply joint compound in 3 coats (not including prefill of openings in base), and sand between last 2 coats and after last coat sufficient to leave no imperfections in a smooth finish. **Obtain Level 4 finish classification.**
- E. Partial Finishing: Omit third coat (if specified) and sanding on concealed drywall work which is indicated for drywall finishing or which requires finishing to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.
  - 1. Refer to sections on painting, coatings and wall-coverings in Division-9 for decorative finishes to be applied to drywall work.

### 3.9 PROTECTION OF WORK

- A. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall work being without damage or deterioration at time of substantial completion.

END OF SECTION 09 25 00

## SECTION 09 51 10 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes:
  - 1. Acoustical panel ceilings, exposed suspension.
  - 2. Acoustical batt insulation above ceilings.

#### 1.03 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. 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. Full-size samples of each acoustical panel type, pattern, and color.
  - 3. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.
- D. 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.

#### 1.04 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), Warnock Hersey, 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.



3. Acoustical panel ceilings indicated are identical in materials and construction to those tested for fire resistance per ASTM E 119.
  4. Acoustical panel materials shall contain less than 1% asbestos.
  5. Products are identified with appropriate markings of applicable testing and inspecting agency.
- 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.

#### 1.05 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.

#### 1.06 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.

#### 1.07 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, and partition assemblies.

#### 1.08 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

#### 2.01 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.
  - 2. Test Method for Ceiling Attenuation Class (CAC): Where acoustical panel ceilings are specified to have a CAC, provide units identical to those tested per ASTM E 1414 by a qualified testing agency.

#### 2.02 NON-FIRE RATED CEILING PANELS (TYPE C-1 and C-2)

- A. Equal to Armstrong Cork Company's Minaboard Design Cortega pattern, #704, size as shown on drawings, 5/8" thick, lay-in, fissured pattern. Tegular edge Class A panel with flame spread rating of 25, color: white. Equal products of Conwed, Celotex, and United States Gypsum Co. are acceptable.

#### 2.03 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.
- 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. Mechanical Diffusers: Provide additional support as required at diffusers.
- F. 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.

#### 2.04 NON-FIRE-RESISTANCE-RATED, DIRECT-HUNG SUSPENSION SYSTEMS

- A. Standard-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from prepainted or electrolytic zinc-coated, cold-rolled steel sheet, with prefinished 9/16-inch-wide metal caps on flanges; other characteristics as follows:
  - 1. Structural Classification: Intermediate-duty system.
  - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.

3. Cap Material and Finish: Steel sheet painted to match ceiling panels.
- B. Products: Subject to compliance with requirements, provide one of the following:
  1. Standard-Face, Capped, Double-Web, Steel Suspension Systems:
    - a. 15/16" Exposed Tee System; Armstrong World Industries, Inc.

#### 2.05 ACOUSTICAL SEALANT

- A. 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.
- B. Products: Subject to compliance with requirements, provide one of the following:
  1. Acoustical Sealant for Concealed Joints:
    - a. BA-98; Pecora Corp.
    - b. Tremco Acoustical Sealant; Tremco, Inc.

#### 2.06 MISCELLANEOUS MATERIALS

- A. Sound Attenuation Blanket Insulation: 3-1/2" thick R-11 fiberglass insulation – unfaced.

### PART 3 - EXECUTION

#### 3.01 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.

#### 3.02 PREPARATION

- A. Coordination: Furnish layouts for 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. Review with Architect prior to starting work to minimize odd shaped pieces at borders.
  1. Where 2' x 2' panels are indicated, provide 2' x 4' panels for areas where the borders may have small odd shaped panel slivers that would be better fitted with pieces longer than 2'.

#### 3.03 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.
  2. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
  3. U.B.C. Standard for Ceiling Suspension Systems: U.B.C. Standard No. 25-2.
- 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 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 bracing wires to ceiling suspension members and to supports with a minimum of 4 tight turns. Fasten bracing wires to concrete with cast-in-place or postinstalled anchors.
  6. 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 (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.18 mm in 3.66 m). Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide neat, precise fit.
1. For tegular-edged panels, install panels with routed faces fully hidden from view by flanges of suspension system runners and moldings.

### 3.04 ACOUSTICAL INSULATION

- A. Install sound attenuation blankets above top of partitions as shown on Drawings. Extend 2'-0" in each direction of the wall, horizontally.

3.05 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 09 51 10

## SECTION 09 65 00 - RESILIENT FLOORING

### PART 1 - GENERAL

#### 1.01 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.

#### 1.02 DESCRIPTION OF WORK

- A. Extent of resilient flooring and accessories is shown on drawings and in schedules.
- B. Types of resilient flooring include:
  - 1. Rubber base.

#### 1.03 QUALITY ASSURANCE

- A. Manufacturer: Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.
- B. Installer's Qualifications: Engage Installer who is certified in writing by resilient flooring manufacturer as qualified for installation of sheet vinyl employing heat welded seams.

#### 1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for each type of resilient flooring and accessory.
- B. Maintenance Instructions: Submit 2 copies of manufacturer's recommended maintenance practices for each type of resilient flooring and accessory required.

#### 1.05 PROJECT CONDITIONS

- A. Maintain minimum temperature of 65 deg F (18 deg C) in spaces to receive resilient flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 55 deg F (13 deg C) in areas where work is completed.
- B. Install resilient flooring and accessories after other finishing operations, including painting, have been completed. Do not install resilient flooring over concrete slabs until the latter have been cured and are sufficiently dry to achieve bond with adhesive as determined by resilient flooring manufacturer's recommended bond and moisture test.

### PART 2 - PRODUCTS

#### 2.01 BASE

- A. Rubber base, thermoplastic vulcanized, 4" and 6" high unless noted otherwise, approximately 1/8" thick with rounded top, coved bottom and supplied in continuous rolled

lengths. Sectional lengths not permitted. Provide factory pre-formed exterior corners. Color and manufacturer as selected by Architect on Room Finish Schedule.

## 2.02 MISCELLANEOUS MATERIALS

- A. Adhesives (Cements): Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.

## PART 3 – EXECUTION

### 3.01 INSTALLATION OF ACCESSORIES

- A. Apply wall base to walls, columns, pilasters, casework, and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with preformed outside corner units and mitered or coped inside corners. Use cut-off pre-molded corners where base wraps around gypsum wallboard edge and returns to stop against door frames. Tightly bond base to substrate throughout length of each piece, with continuous contact at horizontal and vertical surfaces.

### 3.02 EXTRA STOCK

- A. Deliver stock of maintenance materials to Owner. Furnish maintenance materials from same manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.
  - 1. Base: Not less than 50 lineal feet for each type, color and pattern installed.

END OF SECTION 09 65 00

SECTION 09 68 00 - CARPETING

PART 1 - GENERAL

1.01 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.

1.02 DESCRIPTION OF WORK

- A. Extent of carpeting is indicated on drawings, finish schedule and by specifications, and is defined to include carpet and accessories.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Firm with not less than 5 years of experience in installation of commercial carpeting of type, quantity and installation methods similar to work of this section.
- B. General Terminology/Information Standard: Refer to current edition of "Carpet Specifier's Handbook" by The Carpet and Rug Institute; for definitions of terminology not otherwise defined herein, and for general recommendations and information.
- C. Measurement Verification: It is the Flooring Contractor's responsibility to verify all dimensions and job site conditions; order sufficient yardage to fully carpet as indicated and to fill overage requirements as specified. No substitutions shall be permitted to make up for any shortage of material in overage or in carpet to be installed.
  - 1. Flooring Contractor shall be totally responsible for the accuracy of his measurements of total yardage, individual floor yardage, dye lot yardage requirements, extra yardage for pattern match, and roll length requirements. No additional compensation shall be allowed for shortage of materials, except where drawings prove inaccurate in terms of gross quantity.
- D. Dye Lots: All carpet of the same type in continuous areas shall be from the same dye lots.

1.04 SUBMITTALS

- A. Certification as Approved Installer: Submit written certification from manufacturer approving installer for this project.
- B. Product Data: Submit manufacturer's complete technical product data for each type of carpet and accessory items required. Certify that the carpeting contains no undyed yarn fibers.
- C. Indoor Air Quality Test Data: Submit test results showing that total VOC emissions are less than 0.6 milligram per square meter of carpet per hour ( $\text{mg}/\text{m}^2/\text{hr}$ ), styrene emissions are less than  $0.4 \text{ mg}/\text{m}^2/\text{hr}$ , 4-PC emissions are less than  $0.1 \text{ mg}/\text{m}^2/\text{hr}$ , and formaldehyde emissions should be less than  $0.05 \text{ mg}/\text{m}^2/\text{hr}$ .
  - 1. Provide MSDS sheets or other information showing calcium chloride and alkalinity content.



- D. Samples: Submit samples of each carpet required and 6" long samples of each type exposed edge stripping.
- E. Maintenance Data: Submit manufacturer's printed maintenance recommendations, including methods and frequency recommended for maintaining carpeting optimum conditions under anticipated traffic and use conditions.

#### 1.05 TESTING

- A. Test Reports: Submit certified test reports evidencing compliance with requirements for the following:
  - 1. Fire performance characteristics.
  - 2. Physical properties indicated.
- B. Fire Performance Characteristics: Provide carpeting that is identical to that tested for the following fire performance requirements, according to test method indicated, by U.L. or other testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Flammability: As follows:
    - a. Rating: Passing Methanamine Pill Test.
    - b. Test Method: ASTM D 2859.
  - 2. Surface Burning Characteristics: As follows:
    - a. Flame Spread: Not more than 75.
    - b. Smoke Developed: Not more than 100.
    - c. Test Method: ASTM E 84.
  - 3. Critical Radiant Flux: As follows:
    - a. Rating: Not less than 0.22 watts per sq. centimeter.
    - b. Test Method: ASTM E 648.
  - 4. Smoke Density: As follows:
    - a. Rating:
      - 1) With flame, 15.4 minimum value.
      - 2) Without flame, 9.1 minimum value.
    - b. Test Method: ASTM E 662.

#### 1.06 PRODUCT DELIVERY AND STORAGE

- A. Deliver carpeting materials in original mill protective wrapping with mill register numbers and tags attached. Maintain wrappers and protective covers in place until carpet is ready for installation. Store inside, in well ventilated area, protected from weather, moisture and soiling.
- B. Cutting: Before roll carpet is cut, it shall be inspected for defects, color variations, or shipping damage and be immediately replaced if any of these conditions exists at no

additional cost to the Owner. Carpet shall be rolled out to insure that carpet rolls are from the same dye lot.

#### 1.07 JOB CONDITIONS

- A. Environmental Conditions: Maintain temperatures in space in accordance with carpet or adhesive manufacturer's recommendations, but in no case less than 60°F for 24 hours prior to, during and after installation. Subfloor temperature should be a minimum 60°F for 24 hours prior to and after installation. Permit no traffic over a newly laid carpet for a minimum of 1 hour after installation.
- B. Precondition: All of the carpet shall be spread in a room on site 24 hours prior to actual installation with the room preconditioned at a minimum of 60°F with humidity between 35% to 65%.

#### 1.08 WARRANTY

- A. 5-Year Bond for All Defective Material and/or Workmanship: Provide bond, agreeing to repair or replace at no cost to the Owner defective materials and workmanship of carpeting work during 5 year warranty period following date of Substantial Completion.
- B. 15-Year Manufacturer's Warranty for Specific Defects: Provide carpet Manufacturer's written 15-year warranty, non-prorated, against product failure covering freight, labor, and material in the following areas:
  - 1. Edge Ravel - wet or dry.
  - 2. Back Delamination - wet or dry.
  - 3. Static protection as stated above.
  - 4. No more than 10% Face Yarn Loss.
  - 5. Loss of 20 lb. Average Tuft Bind - wet or dry.

#### 1.09 MAINTENANCE STOCK

- A. Furnish minimum of twelve (12) 24" x 24" tiles of all colors and types, whichever is greater. Deliver to Owner prior to beginning installation in uncut clearly marked dust-proof wrappings. Obtain signed receipts for same.

### PART 2 - PRODUCTS

#### 2.01 CARPET TILE (CPT 1.1)

- A. Manufacturer: Mannington "Gametime III"
- B. Construction: Tufted Texture Twist Loop
- C. Face Yarn: 100% Type 6, 6 Four-hole Hollow Filament Nylon.
- D. Face Weight: 20 oz.
- E. Size/Width: 24" x 24".
- F. Installation Method: Monolithic
- G. Color: As shown on Room Finish Schedule.

## 2.02 CARPET ACCESSORIES

- A. Carpet Transition and Edge Guard, Metal type:
  - 1. Carpet to concrete transition: Futura Industries 404049 CM 400 MFA
  - 2. Carpet to vinyl tile and sheet vinyl: Schluter – RENO-TK AETK60
- B. Adhesives: If required, waterproof, waterbase, non-flammable carpet adhesive as furnished or recommended and approved by carpet manufacturer in writing for compatibility with carpet backing. Carpet adhesive shall have a flame spread of 75 or less when tested in accordance with ASTM E 84. All floor sealers, seam sealers, and adhesives shall contain no calculated solvents per OSHA Regulation 29 CFR 1910.1200, have no calculated VOC's, and be non-flammable. MSDS Specifications and samples required on product used.
- C. Seaming Cement: Waterproof, non-flammable and non-staining seam adhesive as furnished or recommended and approved in writing by carpet manufacturer. All floor sealers, seam sealers, and adhesives shall contain no calculated solvents per OSHA Regulation 29 CFR 1910.1200, have no calculated VOC's, and be non-flammable. MSDS Specifications and samples required on product used.
- D. Underlayment: Cementitious floor patching compound with latex additive, mixed with water to produce cementitious paste.
- E. Protection Paper: Fortifiber Corporation "Seckure 892", or approved heavy, reinforced, non-staining kraft laminated paper.
- F. Miscellaneous Materials: As recommended by manufacturers of carpet, and selected by Installer to meet project circumstance and requirements.

## PART 3 - EXECUTION

### 3.01 INSPECTION

- A. General: Do not start work until work of other trades are substantially completed. Inspect surfaces to receive carpet and verify that all such work is complete to the point where this installation may properly commence. In the event of discrepancy, notify Contractor. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved. Start of carpet installation indicates acceptance of subfloor conditions and full responsibility for completed work.
- B. Materials: Unroll all goods to verify uniformity, quality, color and texture against the approved samples prior to installation. Any discrepancy should be brought to the attention of the Contractor and Architect.
- C. Dimensions: Measure each space to receive carpeting as a basis of supplying, cutting and seaming the carpet. Do not scale the drawings or calculate sizes from dimensions shown.

### 3.02 PREPARATION

- A. General: All floor preparation described herein is the responsibility of the General Contractor. At the time of bidding, provide proposal to General Contractor for preparation work described herein.

- B. Preparation: Floor areas shall be dry, sound and free from oil, dirt, paint, bond-breaking or curing compounds, or other foreign matter. Clear away debris and scrape up cementitious deposits from surfaces to receive carpeting, damp mop floors with warm water and vacuum clean immediately before installation. Check concrete surfaces to ensure no “dusting” through installed carpet, apply sealer where required to prevent dusting.
- C. Fill low spots and cracks over 1/8” in width with cementitious underlayment. Where flooring is not level, or possesses defects which would telegraph through the carpet and where leveling is required to raise substrate elevation for proper alignment of finished surfaces (i.e.: tile and carpet crush line), apply leveling underlayment in accordance with manufacturer’s instructions. Feather to substrate slab for slope not to exceed 1/8” in 2’-0”.
  - 1. Concrete must be free from scaling and exhibit acid neutrality.
  - 2. Allow underlayment material to fully dry before applying any carpet adhesive.
  - 3. Consult underlayment manufacturer’s directions for drying times and any other special requirements.
  - 4. Grind all ridges, or other uneven surfaces smooth to prevent telegraphing, bulges or protrusions after carpet has been installed.
- D. Moisture: Moisture test concrete floors before beginning installation to determine the dryness of concrete and the compatibility of the adhesive to be used. Test procedures and number of tests to be performed shall be as recommended by the carpet manufacturer.
- E. Vacuum substrate immediately prior to carpet installation, and remove all deleterious substances which would interfere with the installation or be harmful to the work.
- F. Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet during remainder of construction period.

### 3.03 INSTALLATION

- A. General: Comply with manufacturer’s instructions and recommendations for installation of carpet by the direct glue down method. Review seam layout with Owner and obtain Owner approval prior to proceeding.
- B. Carpeting shall be installed with pile lying in the same direction. Cut carpet evenly and accurately to fit neatly at walls, columns, and projections. Extend carpet under open-bottomed and raised-bottom obstructions, and under removable flanges of obstructions.
- C. Installed carpet shall be free from ripples, ravel, frays, puckers, and raw exposed edges. All irregularities in thickness of breadths shall be corrected in a manner recommended by the carpet manufacturer so that the height of all adjacent breadths are equal.
- D. In carpet drops where cross-seams are made, adjoining carpet rolls shall be from the same dye lot.
- E. Extend carpet under open-bottomed obstructions and under removable flanges and furnishings, and into alcoves and closets of rooms indicated to be carpeted unless another floor finish is indicated for such spaces.
- F. Provide cut-outs as indicated for removable access devices in substrate. Secure both sides of cuts to the substrate.

- G. Install carpet edge guards where edge of carpet is exposed; anchor guards to substrate.
- H. Expansion Joints: Do not bridge building expansion joints with continuous carpeting, provide for movement.

#### 3.04 CARPET INSTALLATION BY DIRECT GLUE DOWN METHOD

- A. General: Fit sections of carpeting into each space prior to application of adhesive. Trim edges and butter cuts with seaming cement.
- B. Adhesive: Apply adhesive uniformly to substrate using a notched trowel in accordance with manufacturer's instructions to achieve 100% bond.
- C. Butt carpet edges tightly together to form seams without gaps. Roll entire carpet area lightly to eliminate air pockets and ensure uniform bond. Make sure that carpet will lie perfectly flat and tension free. Remove adhesive promptly from face of carpet.
- D. Apply seaming cement as recommended by carpet manufacturer. Use caution in applying seaming cement so that it is not in evidence on the face of the carpet. Remove adhesive from face promptly upon exposure. Maintain straight seams running true with the lines of the building. Butt carpet seams and edges tightly together, eliminate air pockets and roll to ensure uniform bond everywhere.
- E. Carpet shall be re-rolled on the day following installation to assure complete transfer of adhesive.
- F. Trim: Install in accordance with manufacturer's recommendations, securely fasten to substrate at terminations of carpet and at all exposed edges, center under doors in doorways.

#### 3.05 CLEANING AND PROTECTION

- A. Remove and dispose of debris and unusable scraps.
- B. Vacuum carpet using commercial machine with brush-only element. Remove spots and replace carpet where spots cannot be removed. Remove any protruding face yarn using sharp scissors. Be certain to trim any loose yarns or fibers at all seams.
- C. Following cleaning and vacuuming, carefully protect the carpeting from soiling and damage until final acceptance. Protection shall be accomplished by using specified building paper. Edges shall be lapped 6 inches and secured with non-asphaltic tape. Covering shall be kept in repair and damaged portions replaced during the construction and move-in period.
- D. Maintenance Materials: Deliver specified overrun and usable scraps of carpet to Owner's designated storage space, properly packaged (paper wrapped) and identified. Usable scraps are defined to include roll ends of less than 9'-0" in length, and pieces of more than 2'-0" wide. Dispose of smaller pieces as "construction waste".
- E. Carpet manufacturer will provide a complete maintenance training program to the Owner's custodial staff not limited to, but to include maintenance and restorative repair of carpet product installed.

END OF SECTION 09 68 00

SECTION 09 90 00 - PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.03 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
  - 1. Exposed interior items and surfaces.
  - 2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. Include finishing of miscellaneous interior hardwood trim. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
- 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. Architectural woodwork and casework.
    - c. Finished mechanical and electrical equipment.
    - d. Light fixtures.
    - e. Switchgear.
    - f. Distribution cabinets.
  - 2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
    - a. Furred areas.
    - b. Pipe spaces.
    - c. 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 Underwriter's 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 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
2. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board.

#### 1.04 DEFINITIONS

- A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

#### 1.05 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 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 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.

#### 1.06 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.
- D. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the minimum standards for materials and application as set forth in the Architectural Painting Specification Manual, latest edition as published by Master Painters Institute, available from the Washington State Council Painting and Decorating Contractors of America, 1001 SW Klickitat Way, #204, Seattle, WA 98134, (206) 243-7477.

#### 1.07 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. Federal Specification number, if applicable.
  - 4. Manufacturer's stock number and date of manufacture.
  - 5. Contents by volume, for pigment and vehicle constituents.
  - 6. Thinning instructions.
  - 7. Application instructions.
  - 8. 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.

#### 1.08 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, when the relative humidity exceeds 85 percent, 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

### 2.01 MANUFACTURERS

- A. Qualifications of Manufacturers: Use only the approved paint products of the paint manufacturers listed in the Architectural Painting Specification Manual, latest edition, Chapter 5 MPI Approved Product List or as approved by the Architect.

### 2.02 MATERIALS

- A. Unless otherwise indicated, furnish scheduled products in accordance with Chapters 5, 6, and 7 of referenced Manual, including paint, varnish, stain, enamel, lacquer, fillers, and related products for prime, intermediate, and finish coats.
  - 1. Materials not specifically indicated, but required, such as linseed oil, shellac, thinners, and the like are to be of quality not less than required by applicable Federal or State Specification Standards.
- B. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.
- C. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.
  - 1. Lead content in pigment, if any, is limited to contain not more than 0.06% lead, as lead metal based on the total non-volatile (dry-film) of paint by weight.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.
  - 1. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular areas.
- B. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.

1. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- C. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

### 3.02 PREPARATION

- A. 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 in accordance with Chapter 3, Architectural Specifications Manual, and 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 of problems anticipated with using the specified finish-coat material with substrates primed by others.
  2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    - a. Stain or seal wood to be finished immediately on delivery. Seal edges, ends, faces, undersides, and backsides of wood.
    - b. Seal tops, bottoms, and cutouts of wood doors with a heavy coat of sealer immediately on delivery.
  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. Blast steel surfaces clean as recommended by the paint system manufacturer and in accordance with requirements of SSPC specification SSPC-SP 10.
    - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.

4. Galvanized Surfaces: Clean galvanized surfaces with non-petroleum-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 in accordance with manufacturer's directions.
1. Maintain containers used in mixing and application of 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.

### 3.03 APPLICATION

- A. General: Apply paint in accordance with 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 "schedules."
  2. Provide finish coats that are compatible with primers used.
  3. The number of coats and film thickness required is 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 an even smooth surface in accordance with the manufacturer's directions.
  4. Apply additional coats when 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, convactor 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.
  8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  9. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
  10. Sand lightly between each succeeding enamel or varnish coat.

11. Omit primer on metal surfaces that have been shop-primed and touch up painted.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
  1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- D. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to the manufacturer's directions.
  1. Brushes: Use brushes best suited for the material applied.
  2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
  3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- E. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.
- F. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and 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 assure a finish coat with no burn through or other defects due to insufficient sealing.
- G. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- H. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
  1. Provide satin finish for final coats.
- I. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

### 3.04 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

### 3.05 PROTECTION

- A. Protect work of other trades, whether to be 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 for protection of their work after completion of painting operations.
  1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.06 PAINT SCHEDULE

- A. General: Provide paint systems for the various substrates, as indicated. The titles and code numbers used herein refer to Chapters 5 and 6 of the reference Manual unless otherwise indicated.
- B. Interior Painting Schedule:
- C. General: See Room Finish Schedule, Room Finish Plans, Door Schedule, and Relite Schedule for finish requirements of interior surfaces. Note that painting of doorlite trim, door louvers, and door transoms is required.
  1. Gypsum Wallboard Walls, Ceilings: Int. 9.2A, latex stipple, eggshell or satin gloss, premium grade.
  2. Exposed Ferrous Metal: Int. 5.1E, alkyd, eggshell or satin gloss, premium grade.
  3. Mechanical Hoods, Grilles, Louvers and Electrical Panels: Paint to match adjacent painted surface whether factory pre-finished or not.
  4. Wood (transparent finish): Int. 6.4G, alkyd sanding sealer, stain and varnish, premium grade, satin finish. Wood stain to match Architect's sample.

### 3.07 EXTRA STOCK

- A. Upon completion of this portion of the work, deliver to the Owner extra stock of paint equaling one gallon of each color and gloss used in each coating material used, with all such extra stock tightly sealed in clearly labeled containers. Obtain written receipt for such materials from the Owner and submit copy to the Architect.

END OF SECTION 09 90 00

SECTION 09 95 00 - WALLCOVERINGS

PART 1 - GENERAL

1.01 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.

1.02 DESCRIPTION OF WORK

- A. Extent of wallcovering work required is indicated on drawings and in schedules.
- B. Types of wallcovering required include the following:
  - 1. Vinyl wallcovering.

1.03 QUALITY ASSURANCE

- A. Manufacturer: Provide each type of wallcovering as produced by a single manufacturer, including recommended primers, adhesives, and sealants.
- B. Installer: A firm specializing in wallcovering work with not less than three years of experience in installing wallcoverings similar to those required for this project.
- C. Fire Hazard Classification: Provide materials bearing UL and marking, indicating fire hazard classification of wallcovering, as determined by ASTM E 84.
- D. Provide materials with the following fire hazard classifications:
  - 1. Flame spread not more than 25.
  - 2. Smoke developed not more than 50.
- E. Test Panels: Install 3 test panels of full usable width, including one corner, in areas designated by Architect. Replace test panels which are not acceptable to Architect until satisfactory installation is achieved.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for each type of wall covering and installation materials.
- B. Samples: Submit full width samples of each type of wallcovering, illustrating range of color and pattern variation; submit sets of sample moldings.
- C. Certification: Submit manufacturer's certification that materials furnished comply with requirements specified.
- D. Maintenance Instructions: Submit manufacturer's printed instructions for maintenance of installed work, including precautions for use of cleaning materials which could damage wall covering.

- E. Replacement Materials: After completion of work, deliver to project site not less than 6 linear yards of each type, color, and pattern of wall covering installed. Furnish replacement materials from same production run as materials installed.

#### 1.05 DELIVERY AND STORAGE

- A. General: Comply with instructions and recommendations of manufacturer and as herein specified.
- B. Deliver materials to project site in original packages or containers clearly labeled to identify manufacturer, brand name, quality or grade, and fire hazard classification.
- C. Store materials in original undamaged packages or containers. Do not store rolled goods in upright position. Maintain temperature in storage area above 40 deg F (4 deg C).

#### 1.06 JOB CONDITIONS

- A. Maintain constant minimum temperature of 60 deg F (16 deg C) at areas of installation for at least 72 hours before and 48 hours after application of materials.
- B. Illuminate areas of installation using building's permanent lighting system; temporary lighting alone will not be acceptable.

### PART 2 - PRODUCTS

#### 2.01 VINYL WALL COVERING

- A. General: All wallcoverings to be total weight 20 oz. per square yard minimum, Type II, Class A. Refer to Room Finish Schedule for precise locations, manufacturers, series, colors, etc.

#### 2.02 ACCESSORY ITEMS

- A. Adhesives: Provide manufacturer's recommended adhesive, primer, and sealer, produced expressly for use with selected wall covering on substrate as shown on drawings. Provide materials which are mildew-resistant and nonstaining to wallcovering.
- B. Release Coat: Oil base sealer or enamel undercoater for drywall substrates as recommended by wallcovering manufacturer.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Acclimatize wall covering materials by removing from packaging in area of installation not less than 24 hours before application.
- B. Remove switchplates, wall plates, and surface-mounted fixtures in areas where wall covering is to be applied.
- C. Prime and seal substrates in accordance with wallcovering manufacturer's recommendations for type of substrate. Apply surface sealer to gypsum drywall which will permit subsequent removal of wall covering without damage to paper facing.

- D. Test substrate with electronic moisture meter to verify that surfaces to be covered do not exceed 4% moisture content.

### 3.02 INSTALLATION

#### A. Vinyl Wallcovering:

1. Place wallcovering panels consecutively in order cut from rolls, including filling of spaces above or below openings. Hang by reversing alternate strips except on match patterns.
2. Apply adhesive to back of wallcovering and place in accordance with manufacturer's instructions. Install seams plumb, and at least 6" away from corners. Horizontal seams are not permitted. Overlap seams and double-cut to assure tight closure. Roll, brush, or use broad knife to remove air bubbles, wrinkles, blisters, and other defects. Cut wallcovering evenly to edges of wall penetrations.
3. Trim selvages as required to assure color uniformity and pattern match.

### 3.03 ADJUST AND CLEAN

- A. Replace removed plates and fixtures; verify cut edges of wall coverings are completely concealed.
- B. Remove surplus materials, rubbish, and debris resulting from wall covering installation upon completion of work, and leave areas of installation in neat, clean condition.

END OF SECTION 09 95 00



SECTION 10 50 00 – METAL LOCKERS

PART 1- GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SCOPE

- A. Furnish and install new steel lockers, accessories and finish metal trim as shown or indicated on approved drawings. Concrete or masonry bases, wood furring, blocking or trim as may be required by drawings are included in other sections of this specification.

1.03 SUBMITTALS

- A. Shop Drawings: Submit drawings showing locker types, sizes and quantities, including all necessary details relating to anchoring, trim installation and relationship to adjacent surfaces.
- B. Numbering: The locker numbering sequence shall be provided by the approving authority and noted on the approved drawings returned to the locker contractor.
- C. Color Charts: Provide color charts showing manufacturer's available colors.

1.03 QUALITY ASSURANCE

- A. UNIFORMITY: Provide each type of metal locker as produced by a single manufacturer, including necessary accessories, fittings and fasteners.
- B. JOB CONDITIONS: Do not deliver metal lockers until building is enclosed and ready for locker installation. Protect from damage during delivery, handling, storage and installation.

PART 2- PRODUCTS

2.01 MANUFACTURER:

- A. **Republic Storage Systems, LLC.** Standard Lockers: Products by Penco, Art Metal are approved provided they meet the detailed specifications below.

2.02 LOCKERS

- A. Description
  - 1. Style: Double Tier
  - 2. Type: Standard
  - 3. Size: 12” wide by 18” deep by 36” high. Overall height 72”
  - 4. Color: Selected from Manufacturer’s standard colors.

## 2.03 FABRICATION - GENERAL

- A. **MATERIAL:** All major steel parts shall be made of mild cold rolled steel, free from imperfections and capable of taking a high grade enamel or powder coat finish.
- B. **FINISH:** Surfaces of the steel shall be thoroughly cleaned, phosphatized and prepared for baked enamel or powder coat finish in accordance with paint manufacturer's instructions.
- C. **CONSTRUCTION:** Lockers shall be built on the unit principle - each locker shall have an individual door and frame, an individual top, bottom, back and shelves with common intermediate uprights separating units.
- D. **DOOR FRAMES:** Door frames shall be 16 gauge formed into 1" wide face channel shapes with a continuous vertical door strike, integral with the frame on both sides of the door opening. Double, triple or four tier locker cross frame members shall be 16 gauge channel shaped securely welded to vertical framing members to ensure a square and rigid assembly. Intermediate cross frame members are not required on box lockers.
- E. **DOORS:** Shall be 16 gauge or 18 gauge steel for short or narrow doors as required by manufacturer's design, formed with a full channel shape on the lock side to fully conceal the lock bar, channel formation on the hinge side and right angle formation across the top and bottom. Locker doors shall be ventilated by louvers on the face of each door, top and bottom.
- F. **PRE- LOCKING DEVICE:** All "tiered" lockers shall be equipped with a positive automatic pre-locking device, whereby the locker may be locked while door is open and then closed without unlocking and without damaging locking mechanism.
- G. **LATCHING:** Latching shall be a one-piece, pre-lubricated spring steel latch, completely contained within the lock bar under tension to provide rattle-free operation. The lock bar shall be of pre-coated, double-channel steel construction. The lock bar shall be securely contained in the door channel by self-lubricating polyethylene guides that isolate the lock bar from metal-to-metal contact with the door. There shall be three latching points for lockers over 42" in height and two latching points for all tiered lockers 42" and under in height. The lock bar travel is limited by contacting resilient high-quality elastomeric cushioning devices concealed inside the lock bar. Frame hooks to accept latching shall be of heavy gauge steel, set close in and welded to the door frame. Continuous vertical door strike shall protect frame hooks from door slam damage. A soft rubber silencer shall be securely installed on each frame hook to absorb the impact caused by closing of the door. Box locker doors shall be equipped with a padlock hasp and a stainless steel strike plate with an integral handle pull. Box locker doors may also be equipped with built-in locks.
- H. **HANDLES:** A non-protruding 14 gauge lifting trigger and slide plate shall transfer the lifting force for actuating the lock bar when opening the door. The exposed portion of the lifting trigger shall be encased in a molded ABS thermoplastic cover that provides isolation from metal-to-metal contact and be contained in a formed 20 gauge stainless steel recessed pocket. This stainless steel pocket shall contain a recessed area for padlocks and a mounting area for the number plate.

- I. HINGES: Hinges shall be 2" high, 5-knuckle, full loop, tight pin style, securely welded to frame and double riveted to the inside of the door flange. Locker doors 42" high and less shall have two hinges.
- J. BODY: The body of the locker consists of 24 gauge upright sheets, backs, tops, bottoms and shelves. Tops, bottoms and shelves are flanged on all four sides; backs are flanged on two sides. Uprights shall be offset at the front and flanged at the rear to provide a double lapped rear corner. All bolts and nuts shall be zinc plated.
- K. INTERIOR EQUIPMENT: All double tier lockers shall have one double prong rear hook (single prong in 9" width) and two single prong wall hooks in each compartment. All hooks shall be made of steel, formed with ball points, zinc-plated and attached with two bolts or rivets.
- L. NUMBER PLATES: Each locker shall have a polished aluminum number plate with black numerals not less than 1/2" high. Plates shall be attached with rivets to the lower surface within the recessed handle pocket.
- M. COLOR: Doors and exposed body parts shall be finished in colors selected from Manufacturer's collection of powder coat colors. Non-exposed body parts shall be manufacturer's standard baked enamel finish.
- N. ASSEMBLY: Assembly of all locker components shall be accomplished by the use of zinc plated, low round head, slotless, fin neck machine screws with hex nuts, producing a strong mechanical connection.

### PART 3 - EXECUTION

#### 3.01 GENERAL

- A. INSTALLATION: Lockers must be installed in accordance with manufacturer's approved drawings and assembly instructions. Installation shall be level and plumb with flush surfaces and rigid attachment to anchoring surfaces. Space fasteners at 36" O.C. or less, as recommended by manufacturer. Use fasteners appropriate to load and anchoring substratum. Use reinforcing plates wherever fasteners could distort metal. Various trim accessories where shown, such as sloping tops, fillers, bases, recessed trim, etc., shall be installed using concealed fasteners. Flush, hairline joints are provided at all abutting trim parts and at adjoining surfaces.
- B. ADJUSTMENT: Upon completion of installation, inspect lockers and adjust as necessary for proper door and locking mechanism operation

END OF SECTION 10 50 00

## SECTION 12 50 00 - WINDOW TREATMENT

### PART 1 - GENERAL

#### 1.01 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.

#### 1.02 DESCRIPTION OF WORK

- A. Types of window treatment work in this section include:
  - 1. Horizontal blinds
- B. Extent of horizontal blinds includes interior glazed openings as follows:
  - 1. Relite R112 and R114.

#### 1.03 QUALITY ASSURANCE

- A. General: Provide window treatment units which are complete assemblies produced by one manufacturer for each type required, including hardware, accessory items, mounting brackets, and fastenings.
- B. Furnish materials in colors and patterns as indicated, or, if not indicated, as selected by Architect from manufacturer's standard colors/patterns.

#### 1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of window treatment unit required. Include methods of installation for each type of opening and supporting structure.
- B. Shop Drawings: Submit shop drawings for special components and application conditions of window treatment units which are not fully dimensioned or detailed in manufacturer's product data. Show relationships to adjoining work. Provide wiring diagrams for motorized units.
  - 1. Include typical elevation layout indicating proposed division between blind units and meeting edges at corners. Provide sections and details at head and sill between blind units and corners including inclined installations.
- C. For initial selection of colors, submit manufacturer's color charts consisting of sections of exposed components with integral or applied finishes showing full range of colors, materials, etc. available for each type of window treatment assembly required.

### PART 2 - PRODUCTS

#### 2.01 HORIZONTAL BLINDS

- A. Headrail: Manufacturer's standard headrail consisting of channel-shaped section complete with tilting mechanism, top and end braces, top cradles, cord lock, and accessory items required for type of blind and installation indicated.
- B. Bottom Rail: Manufacturer's standard tubular steel bottom rail, designed to withstand twisting or sagging. Contour top surface to match slat curvature, with flat or slightly curved bottom. Close ends with manufacturer's standard metal or plastic end caps, of same color as rail. Finish rail in same color as slats, unless otherwise indicated.
- C. Slats: Manufacturer's standard, aluminum slats, nominal 0.006" thick, (louver blades), rounded corners with forming burrs removed, as follows:
  - 1. Slat Width: 1" (25mm) nominal slats, with other components sized to suit.
  - 2. Provide slats designed and spaced to achieve maximum overlap and closure for optimum light exclusion. Notch rear of blade at ladders and offset rout holes at lift cords to enable blades to touch one another when closed.
- D. Ladders: Manufacturer's standard ladder construction designed to support and maintain slats at proper spacing and alignment in open and closed positions, as follows:
  - 1. Braided polyester cord design consisting of vertical components of not less than 0.043" nor more than 0.068" in diameter and integrally braided ladder rungs of not less than 4 threads; space ladders not further than 23" apart and 7" from ends of slats.
- E. Tilting Mechanism: Manufacturer's standard assembly including disengaging worm and gear mechanism to eliminate overdrive, low friction gear tilter, drum and cradle at each ladder, tilt rod, tape clips, and grommet guides to prevent wear on ladder and cords; designed to hold slats at any angle and prevent movement of slats due to vibration, operated as follows:
  - 1. Wand Operation: Manufacturer's standard, detachable clear plastic wand, of proper length to suit blind installation, to provide convenient operation, and detachable without tools by raising locking sleeve. Provide extra length wand to 6'-0" height above floor at windows with sills higher than 6'-0" above floor; provide extra length cords at these same windows.
- F. Lifting Mechanism: Manufacturer's standard including crash-proof cord locks with cord separators and braid polyester or nylon lift cords with tassels at ends. Size cord to suit blind type. Include cord equalizers of self-aligning type designed to maintain horizontal blind position.
- G. Installation Brackets: Manufacturer's standard brackets designed to facilitate removal of head channels. Provide intermediate brackets at spacing recommended by blind manufacturer. Include hardware necessary for secure attachment of brackets to adjoining construction and to head rails. Design brackets to support safely the weight of blind assemblies plus forces applied to operate blinds.
- H. Finish: Provide finishes indicated below. Finish exposed accessories and hardware to match rail color. Provide manufacturer's standard corrosion resistant finish to concealed items of hardware.

1. Steel Components: Galvanize and either phosphate coat or prime exposed steel surfaces, followed by manufacturer's standard baked-on synthetic resin enamel finish.
  2. Aluminum Slats: Provide manufacturer's standard factory-applied finish system consisting of chemical conversion coating followed by baked-on synthetic resin enamel finish coat.
- I. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
1. Bali Classic Mini.
  2. Breneman.
  3. Hunter Douglas, Inc.
  4. Levelor Lorentzen, Inc.
  5. Marathon Carey-McFall Div., Marathon Mfg. Co.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. General: Install window treatment units in framed window head to comply with manufacturer's instructions. Position units level, plumb, secure, at proper height and location relative to adjoining window units and other related work. Securely anchor units with proper clips, brackets, anchorages, suited to type of mounting indicated.
- B. Location for Interior Unit Mounting: Always opposite side of glass from corridors, hallways or as noted on Door and Relite Schedules.
- C. Mounting at exterior windows: Head mount, adjacent to frame.
- D. Provide adequate clearance between sash and blinds to permit unencumbered operation of sash hardware.
- E. Isolate metal parts from concrete and mortar to prevent galvanic action. Use tape or thick coating or other means recommended by manufacturer to effect separation.
- F. Protect installed units to ensure their being in operating condition, without damage, blemishes, or indication of use at completion of project. Repair or replace damaged units as directed by Architect.

END OF SECTION 12 50 00

## SECTION 21 05 00 – GENERAL FIRE PROTECTION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Provide all materials, labor, equipment design and services necessary to modify the existing wet fire sprinkler system as needed to accommodate the office remodel as shown on the drawings and as described herein.
- B. The Owner has drawing of the existing system.

#### 1.03 SCOPE OF WORK

- A. Fire sprinkler systems shall be hydraulically calculated, wet pipe systems, designed in accordance with NFPA 13 and NFPA 14 for the following conditions:
  - 1. Sprinkler systems shall be designed for Light Hazard occupancy, including spaces above ceilings in existing and new construction where construction is combustible.

#### 1.04 SUBMITTALS

- A. Product Data: Furnish a complete list of fire protection equipment and products, and manufacturer's catalog data sheets and maintenance data sheets for each item to be included in the project.
- B. Shop Drawings: Submit drawings which have been prepared in accordance with NFPA 13 identified as "Working Plans," including hydraulic calculations, and which have been approved by the authority having jurisdiction. Submit evidence of final drawing approval by the authority having jurisdiction prior to the start of fabrication or installation.

#### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: All above ground fire sprinkler system work shall be performed by a licensed fire sprinkler contractor in the State of Washington holding a Level III Certificate of Competency.

#### 1.06 CODES AND STANDARDS

- A. Code Compliance: Comply with most current adopted edition of following:
  - 1. International Building Code (IBC), Standards and Amendments.
  - 2. International Mechanical Code (IMC), Standards and Amendments.
  - 3. International Fire Code (IFC), Standards and Amendments.
  - 4. National Fire Protection Association (NFPA).
  - 5. National Electrical Code (NEC); NFPA 70.
  - 6. Applicable State and local codes, laws and ordinances

## 1.07 APPROVALS

- A. For purposes of code compliance, the Authority Having Jurisdiction will be the City of Spokane Fire Marshall. Where there is a conflict between the Authority Having Jurisdiction and the referenced codes and standards, the most stringent shall apply.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. **Materials and Equipment:** All fire protection system materials and equipment shall be new and current products of a manufacturer regularly engaged in the production of such materials and equipment.
- B. **Approval Guides:** All fire protection system materials and equipment shall be listed in the latest publication of the Underwriter's Laboratories Fire Protection Directory or the Factory Mutual Approval Guide.

### 2.02 PIPE AND TUBING MATERIALS

- A. Pipe or tubing shall be metallic and meet or exceed the standards of NFPA 13.

### 2.03 PIPE FITTINGS

- A. **Threaded Fittings:** ANSI B16.4, Class 125, rated for 175 psi, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.
- B. **Steel Fittings:** ASTM A 234, seamless or welded, for welded joints.
- C. **Grooved Mechanical Fittings:** ASTM A 47, malleable-iron fittings with grooves or shoulders designed to accept grooved end couplings.
- D. **Grooved Mechanical Couplings:** Consist of ductile or malleable iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure roll-grooved pipe and fittings.

### 2.04 HANGERS AND SUPPORTS

- A. Provide hangers to support all piping in perfect alignment without sagging or interference, to permit free expansion and contraction, and meet the requirements of NFPA 13.
- B. Pipe rings shall be zinc-coated. Grinnell figure 69 or approved equal.
- C. Hanger rods to be electro-galvanized.

### 2.05 SPRINKLERS

- A. Provide automatic sprinklers throughout. Sprinklers in finished ceilings shall be glass bulb type with white finish and white recessed escutcheon unless otherwise noted. Temperature rating of sprinkler shall be as required by application. Extended coverage sprinklers may be used where installed in accordance with NFPA 13 and UL/FM listings.



### PART 3 - EXECUTION

#### 3.01 PIPING INSTALLATIONS

- A. Deviations from approved "working plans" for fire sprinkler piping, require approval of the authority having jurisdiction and shall be made only after careful coordination with other Trades on the project and the Architect.
- B. Piping shall be so arranged to allow space for other equipment and piping. Coordinate all work with other trades on the job, and where necessary to alter work, it shall be done at no extra charge to the Owner. Install piping to provide maximum head height.
- C. Install sprinkler piping to provide for system drainage in accordance with NFPA 13.
- D. Hangers and Supports: Comply with requirements of NFPA 13 and NFPA 14. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in accordance with the grooved mechanical coupling manufacturer's written instructions, for rigid systems.

#### 3.02 SPRINKLER INSTALLATION

- A. Use proper tools to prevent damage during installations. Sprinkler head layout in finished ceiling areas shall be symmetrical with all heads in straight lines and evenly spaced with respect to lighting fixtures, etc.
- B. Sprinkler heads located in 2'x 2' lay-in type ceiling panel shall be centered in tile unless otherwise indicated. Sprinkler heads located in 2'x 4' lay-in type ceiling panel shall be centered in tile or located at quarter points unless otherwise indicated.

END OF SECTION 21 05 00

## SECTION 22 05 00 – GENERAL REQUIREMENTS FOR PLUMBING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.
- B. Related Sections include the following:
  - 1. Division 22 Section “Common Materials and Methods for Plumbing”.
  - 2. Division 22 Section “Hangers and Supports for Plumbing Piping and Equipment”.

#### 1.02 SCOPE OF WORK – GENERAL

- A. This section specifies general requirements for plumbing installations and includes requirements common to more than one section of Division 22. It expands and supplements the requirements specified in sections of Division 01.
- B. Provide materials, labor, transportation, tools, permits, fees, inspections, utilities and incidentals necessary for the complete installation of plumbing work indicated and described in the Contract Documents.
- C. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified under this section of work or work specified in other sections, provide material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.

#### 1.03 SEQUENCE OF WORK

- A. Conduct work in sequence to provide least possible interference to the activities of the Owner, and to permit orderly transfer of activities and equipment to completed areas.
- B. Work shall be substantially complete by the dates listed in Division 01 Section “Summary of Work”.

#### 1.04 DEFINITIONS

- A. Provide: Furnish and install complete and ready for intended use.
- B. Indicated: Indicated on drawings.
- C. Noted: Noted on Drawings or in Specifications.

- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- H. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

#### 1.05 CODES AND STANDARDS

- A. Code Compliance: Comply with most current adopted edition of following:
  - 1. International Building Code (IBC), Standards and Amendments.
  - 2. International Mechanical Code (IMC), Standards and Amendments.
  - 3. International Fire Code (IFC), Standards and Amendments.
  - 4. Uniform Plumbing Code (UPC), Standards and Amendments.
  - 5. International Fuel Gas Code (IFGC).
  - 6. National Fire Protection Association (NFPA).
  - 7. National Electrical Code (NEC); NFPA 70.
  - 8. Applicable State and local codes, laws and ordinances.

#### 1.06 SAFETY OF PERSONS AND PROPERTY

- A. Comply with applicable laws, ordinances, rules and regulations of any public authority for the safety of persons and property, including requirements of the Washington Industrial Safety and Health Administration (WISHA) and/or the Occupational Safety and Health Act (OSHA) and Division 01, General and Supplementary Conditions.

#### 1.07 PERMITS AND FEES

- A. Obtain and pay for required permits and fees necessary to fully complete work included in the Contract Documents.

#### 1.08 INTENT AND INTERPRETATION

- A. Drawings and Specifications supplement each other and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

- B. Drawings are partly diagrammatic and do not necessarily show exact location of new piping and existing utilities, unless specifically dimensioned.
- C. Riser and other diagrams are schematic only and do not necessarily show the physical arrangement of equipment. They shall not be used for obtaining quantities or lineal runs of piping.
- D. Fixtures or other pieces of equipment shall be centered on windows, wall spaces, or other items, unless specifically dimensioned otherwise.
- E. Location of piping shall be checked to determine that it clears openings and structural members; that it may be properly concealed; and that it clears cabinets, lights and equipment having fixed locations.
- F. Mechanical drawings shall serve as working drawings for Division 22 work. Refer to Architectural, and Electrical drawings for additional detail affecting the installation of work. Architectural drawings shall take precedence over the Mechanical drawings if any dimensional discrepancies exist.
- G. Approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details in regard to location. Exact locations are to be determined by actual measurements at the building. Not all pipe and duct offsets are indicated on the drawings.

#### 1.09 SUBMITTAL OF EQUIPMENT FOR APPROVAL

- A. Refer to Division 01 requirements for submittal definitions, requirements and procedures. Additional requirements are listed below.
- B. Shop drawings, catalog information, and material schedules shall be submitted for approval on materials and equipment prior to ordering.
- C. Submittals not meeting the following requirements will be returned for revision:
  - 1. Provide a cover page for each item or group of items (schedule group, single fixture plus trim group, etc.). Cover page shall provide a 3" x 5" space for Engineer's review stamp
  - 2. Each cover page must be clearly identified with the project name, specification number and paragraph number.
  - 3. Submittal package must be accompanied by an itemized index listing specification section, paragraph number, item and manufacturer; larger projects will be index tabbed by specification section with index for each section.

#### 1.10 SCHEDULE OF VALUES

- A. Furnish to the Engineer, a breakdown of the Contract for work in Division 22 within 30 days of Notice to Proceed.

- B. The breakdown shall list cost for materials and labor as follows:
  - 1. Miscellaneous Overhead Expenses
  - 2. Plumbing Demolition
  - 3. Plumbing Rough-in:
    - a. Aboveground Piping
    - b. Pipe Insulation
  - 4. Plumbing Finish:
    - a. Fixtures
    - b. Plumbing Equipment
    - c. Final Connection
  - 5. Project Closeout:
    - a. O & M Manuals
    - b. Record Documents

#### 1.11 GUARANTEE

- A. Guarantee satisfactory operation of material and equipment installed under Division 22. Repair or replace any defective materials, equipment, or workmanship which may show itself within one year from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. Where more than one manufacturer is listed, provide products of only one manufacturer for each type of product.
- B. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated “new” equipment is not acceptable.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### 2.02 EQUIPMENT AND MATERIAL SUBSTITUTIONS

- A. Throughout these Contract Documents, various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, type or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of the bid.
- B. Where more than one manufacturer is listed, and only one manufacturer's catalog number is indicated, that standard of quality and construction shall be maintained by materials supplied by other manufacturer(s).

- C. Substitutions of equipment or materials shall be made only with written prior approval. Prior approval requests must be received at least ten (10) days prior to bid date unless otherwise instructed. Refer to Division 01 Section "Substitution Procedures" for procedures in requesting substitutions. The Owner or Owner's representative shall review all substitution requests for final approval.
- D. Substitution request must include manufacturer, specific model number, special features, physical dimensions, and capacities of proposed equipment. Verify requirements before submitting for approval.
- E. The Contractor shall bear full responsibility for substituted equipment and materials, including, but not limited to:
  - 1. Costs.
  - 2. Available space requirements
  - 3. Effect on other trades
  - 4. Changes in electrical requirements
  - 5. Changes in structural requirements.

### PART 3 - EXECUTION

#### 3.01 COORDINATION

- A. Refer to Division 01 Section "Project Coordination".
- B. Coordinate available space for equipment and systems with other trades. Refer to Architectural and Electrical Drawings for additional building details necessary for coordination.
- C. Cutting, patching, wiring, finishing or any other work required for relocation of work installed due to interferences between work of the various trades will be at no additional cost to the Owner.

#### 3.02 MANUFACTURER'S INSTRUCTIONS

- A. Furnish proper equipment and/or materials required for installation as intended by the manufacturer, for all work described under Division 22. If needed for proper installation or operation, request advice and supervisory assistance from the representative of the specific manufacturer. Manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated. Promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and obtain the Architect's instructions before proceeding with the work.

### 3.03 LAYING OUT WORK

- A. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Exact locations of such items shall be determined from the Construction Drawings. Verify physical dimensions of each item of mechanical equipment, ductwork system and piping system, to fit available space and promptly notify the Architect prior to roughing-in if conflicts appear. Coordinate equipment to available space and access routes through construction. Offsets or transitions in ductwork or piping systems required for proper system operation and/or installation, whether indicated on drawings or not, shall be provided at no additional cost to Owner.

### 3.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
- C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

### 3.05 ACCESSIBILITY

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate location of concealed equipment and devices requiring access with location of access panels and doors. Allow ample space for removal of parts that require replacement or servicing.

### 3.06 TEMPORARY USE OF NEW EQUIPMENT

- A. New equipment shall not be used for temporary plumbing unless authorized in writing by the Owner.

END OF SECTION 22 05 00

## SECTION 22 05 07 – PLUMBING DEMOLITION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.
- B. Related Sections include the following:
  - 1. Division 01 Section “Summary of Work” for phasing requirements.
  - 2. Division 01 Section “Cutting and Patching”.
  - 3. Division 01 Section “Selective Demolition” for general demolition requirements and procedures.

#### 1.02 SUMMARY

- A. Include all labor, equipment, and materials necessary to complete demolition of existing plumbing systems as shown on the drawings and described herein.
- B. Mechanical Services to areas occupied by Owner shall be maintained.

#### 1.03 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

### PART 2 - SALVAGE

#### 2.01 MATERIALS OWNERSHIP

- A. The Owner shall have first salvage rights to all removed fixtures and equipment. Coordinate selection with the Owner's Representative.
- B. Except for items or materials to be reused, salvaged, reinstalled or otherwise indicated to remain owner's property, demolished materials shall become Contractor's property and removed from Project site.



- C. Transport and legally dispose of, off site, all materials resulting from demolition not being salvaged.

### PART 3 - EXECUTION

#### 3.01 DEMOLITION

- A. Condition and Premises: The Owner assumes no responsibility for condition of areas to be demolished. General conditions existing at time of inspection for bidding purposes will be maintained by Owner.
- B. Partial Removal: Items of salvageable value to Contractor indicated to be removed may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage or sale of removed items on site will not be permitted.
- C. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.
- D. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.
- E. Existing Utility Services: Maintain existing utilities indicated to remain, keep in service and protect against damage during demolition operations.
- F. Cut and/or patch and repair all existing floor, wall and roof penetrations not being re-used. Comply with Division 01 Section requirements.
- G. Not all piping or equipment items are shown on drawings. Other demolition may be required.
- H. Any existing piping that is to be reused or left in existing position shall have the opening of such covered and protected during demolition and construction until final connections can be made.
- I. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment. Equipment removal shall include removal of all connecting piping, etc., either to a point below floor behind wall surface, etc.
  - 4. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

- J. If pipe, insulation, or equipment to remain is damaged in appearance during construction, or is rendered unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

END OF SECTION 22 05 07

## SECTION 22 05 09 – COMMON MATERIALS & METHODS FOR PLUMBING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to plumbing systems.
  - 2. Sleeves.
  - 3. Escutcheons.
  - 4. Equipment installation requirements common to equipment sections.
  - 5. Supports and anchorages.
  - 6. Cutting and patching.

#### 1.03 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

#### 1.04 SUBMITTALS

- A. Product Data: For the following:
  - 1. Escutcheons.

#### 1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

#### 1.07 COORDINATION

- A. Arrange for shut down of piping systems with Owner in order to limit the amount of time the system is out of service and the impact on use of systems not within the remodel area.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers listed.

#### 2.02 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

#### 2.03 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free; 95.6% tin/4% copper/0.4% silver solder; 440-500 deg.F melting range.
- C. Brazing Filler Metals: AWS A5.8, BCuP-5, copper-phosphorus alloys, 15% silver, 1190-1480 deg.F melting range.

## 2.04 SLEEVES

- A. Galvanized-Steel Sheet: 22 gage minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

## 2.05 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With hinge, set screw or spring clips, and chrome-plated finish.

## PART 3 - EXECUTION

### 3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Do not run piping directly over electrical panels or switchgear.

- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Install piping to permit valve servicing.
- H. Install piping at indicated slopes.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install piping to allow application of insulation.
- L. Cap or seal temporary openings in piping during construction. Remove caps or seals for final connections.
- M. Select system components with pressure rating equal to or greater than system operating pressure.
- N. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions where specifically indicated and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.
  - 4. Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.
- P. Verify final equipment locations for roughing-in.
- Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.02 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using AWS A5.8, BAg1, 15% silver alloy brazing filler metal.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

### 3.03 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each threaded valve and at final connection to each piece of equipment.

### 3.04 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- B. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

### 3.05 CUTTING AND PATCHING

- A. Comply with Division 01 Section "Cutting and Patching" for general requirements for cutting and patching.
- B. Cutting shall be performed with masonry saws, core drills or similar equipment to provide neat and uniform openings.

- C. Patching shall match adjacent surfaces in materials and finish. Do not endanger or damage installed work through procedures and processes of cutting and patching.
- D. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations. will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
  - 1. Uncover work to provide for installation of ill-timed work.
  - 2. Remove and replace defective work.
  - 3. Remove and replace work not conforming to requirements of the Contract Documents.
  - 4. Remove samples of installed work as specified for testing.
  - 5. Install equipment and materials in existing structures.
  - 6. Upon written instructions from the Architect, uncover and restore work to provide for observation of concealed work.
- G. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by new work.
- H. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

END OF SECTION 22 05 09



## SECTION 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPE AND EQUIPMENT

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes hangers and supports for plumbing piping and equipment.

#### 1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.04 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Pipe Hangers:
    - a. Anvil International, Inc.
    - b. Globe Pipe Hanger Products, Inc.
    - c. Erico/Michigan Hanger Co., Inc.
    - d. PHD Manufacturing, Inc.
    - e. Thomas & Betts
    - f. Tolco Inc.
    - g. Unistrut Corp.

#### 2.02 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
  - 1. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
  - 2. Nonmetallic Coatings: Plastic coating, jacket or liner.

## 2.03 MISCELLANEOUS MATERIALS

- A. Mechanical-Anchor Fasteners: Insert-wedge type zinc-coated steel, for use in hardened Portland cement with pull-out, tension and shear capacities appropriate for supported loads and building materials where used.
- B. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

## PART 3 - EXECUTION

### 3.01 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
  - 2. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
  - 3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  - 4. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  4. C-Clamps (MSS Type 23): For structural shapes.
  5. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

### 3.02 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Install mechanical-anchor fasteners in concrete according to manufacturer's written instructions.
- C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units. Make allowance for pipe insulation as required.
- E. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- F. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- G. Insulated Piping: Comply with the following:
  1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.9.
  2. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  3. Insert Material: Length at least as long as protective shield.

4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.03 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

END OF SECTION 22 05 29

## SECTION 22 07 00 – PLUMBING INSULATION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes insulation systems for plumbing piping.

#### 1.03 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. PVC: Polyvinyl chloride.
- D. SSL: Self-sealing lap.

#### 1.04 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. For adhesives, sealants and mastics: Documentation including printed statement of VOC content.

#### 1.05 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.07 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application.

## 1.08 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.02 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000 deg. Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Thermal conductivity (k-value) not greater than 0.23 at 75 deg F mean temperature. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

### 2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

- B. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

#### 2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  - 4. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
  - 1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 200 deg F.
  - 3. Solids Content: 63 percent by volume and 73 percent by weight.
  - 4. Color: White.

#### 2.05 SEALANTS

- A. Joint Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Fire and water resistant, flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 4. Color:
    - a. White for ASJ and PVC.
    - b. Aluminum for FSK and metal jackets.
- B. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

#### 2.06 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

## 2.07 TAPES

- A. ASJ Tape: White vapor-barrier tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
- B. PVC Tape: White vapor-barrier tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

## 2.08 SECUREMENTS

- A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- B. Wire: 0.062-inch soft-annealed, stainless steel.
- C. Bands: Stainless-steel or aluminum with wing seals.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.03 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or barriers, jackets, and thicknesses required for each item of equipment, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.



- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 to 6 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.04 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Non-Rated Interior Wall and Partition Penetrations): Install insulation continuously through walls and partitions.

### 3.05 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 4 to 6 inches o.c.
  - 3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-barrier integrity, unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation. Where preformed fitting insulation is not commercially available, use mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive.
  - 3. Insulate tee fittings with preformed fitting insulation. Where preformed fitting insulation is not commercially available, use sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using reusable valve wrap or preformed fitting insulation. Where preformed fitting insulation is not commercially available, use sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts.
5. Insulate strainers using reusable valve wrap or preformed fitting insulation. Where preformed fitting insulation is not commercially available, use sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
8. Install reusable valve wrap or removable insulating fabric fitting covers on valves, elbows, tees, and flanges, strainers or other irregularly-shaped fittings or components where fitted PVC covers are not practical or available.

### 3.06 PIPING INSULATION SCHEDULE, GENERAL

- A. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  1. Fire-suppression piping.
  2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.07 INDOOR PIPING INSULATION SCHEDULE

- A. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Service: Domestic Hot and Recirculated Hot Water.
  1. Operating Temperature: 60 to 140 deg F.
  2. Insulation Material: Mineral-Fiber.
  3. Insulation Thickness: Apply the following insulation thicknesses:
    - a. Pipe, 1-1/4 inch and less: 1.0 inch
    - b. Pipe, > 1-1/2 inch: 1.5 inch
  4. Vapor Barrier Required: None.
- C. Service: Domestic Cold Water.
  1. Operating Temperature: 35 to 60 deg F.
  2. Insulation Material: Mineral-Fiber.

3. Insulation Thickness: Apply the following insulation thicknesses:
  - a. Pipe, 1-1/4 inch and less: 1.0 inch
  - b. Pipe, > 1-1/2 inch: 1.5 inch
4. Vapor Barrier Required: Yes.

END OF SECTION 22 07 00

## SECTION 22 11 16 – DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes domestic water piping and water meters inside the building.

#### 1.03 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
  - 1. Domestic Water Distribution Piping: 125 psig.

#### 1.04 SUBMITTALS

- A. Water Samples: Specified in "Cleaning" Article in Part 3.

#### 1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

### PART 2 - PRODUCTS

#### 2.01 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- C. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

## 2.02 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings.
  - 2. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings.
  - 2. Copper Pressure-Seal Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper fittings with EPDM O-rings, inboard bead design, compression crimp on both sides of the seal bead, minimum 200-psig working-pressure rating at 250 deg F.
    - a. Manufacturers:
      - 1) Nibco
      - 2) Viega
  - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
  - 4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings

## PART 3 - EXECUTION

### 3.01 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:
  - 1. NPS 4 and Smaller: Hard copper tube, Type L copper pressure fittings; and soldered joints.
  - 2. NPS 4 and Smaller: Hard copper tube, Type L copper pressure-seal fittings and joints.

### 3.02 PIPING INSTALLATION

- A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for basic piping installation.
- B. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.

- C. Install copper tubing according to CDA's "Copper Tube Handbook."
- D. Install aboveground domestic water piping level without pitch and plumb.
- E. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

### 3.03 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, 95-5 tin antimony solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. Pressure-Seal Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

### 3.04 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.05 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.

### 3.06 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
  - 1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
  - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

### 3.07 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652.
- B. Prepare and submit reports of purging and disinfecting activities. Provide one copy of cleaning report and acceptance report from a certified laboratory or Health Department upon completion of cleaning and disinfecting activities.

END OF SECTION 22 11 16



## SECTION 22 13 16 – SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.

#### 1.03 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. PVC: Polyvinyl chloride plastic.

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water

#### 1.05 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.

#### 1.06 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

### PART 2 - PRODUCTS

#### 2.01 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

#### 2.02 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: CISPI 301, ASTM A 888 or ASTM A 74, Service class. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be of domestic manufacturer only, no substitutions.

- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
  - 1. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.
    - a. NPS 1-1/2 to NPS 4: 3-inch- wide shield with 4 bands.

### 2.03 ABS PIPE AND FITTINGS

- A. Cellular-Core, ABS Pipe: ASTM F 628, Schedule 40.
- B. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

## PART 3 - EXECUTION

### 3.01 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Aboveground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:
  - 1. NPS 1-1/2 to NPS 6: Hubless, cast-iron soil pipe and fittings, heavy-duty stainless steel couplings.
  - 2. NPS 1-1/2 to NPS 6: Cellular-core, ABS pipe; ABS socket fittings; and solvent-cemented joints. Not allowed in return air plenums.

### 3.02 PIPING INSTALLATION

- A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for basic piping installation.
- B. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- D. Install vent piping free from drops or sags, graded and connected as to drip back by gravity to the drainage pipe it serves.

- E. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- F. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- G. Do not use ABS or PVC plastic piping in return air plenums.
- H. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

### 3.03 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for basic piping joint construction.
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Hubless Joints: Make with rubber gasket and sleeve or clamp.

### 3.04 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
- E. Install hangers for ABS piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
- F. Install supports for vertical ABS piping every 48 inches.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.05 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

### 3.06 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

### 3.07 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 13 16

## SECTION 22 40 00 – PLUMBING FIXTURES

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes plumbing fixtures and related components.

#### 1.03 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

#### 1.04 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
  - 1. Include single product data for accessories (p-traps, stops, supplies, ADA protective shielding guards, etc.) common to multiple fixtures. Identify which fixture symbols each accessory applies to. Do not duplicate product data for common accessories.
- B. Maintenance Data: For plumbing fixtures to include in operation and maintenance manuals.

#### 1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements of the International Building Code (IBC) and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components- Health Effects," for fixture materials that will be in contact with potable water.

- D. Water Conservation: Comply with requirements of the Uniform Plumbing Code (UPC) as amended by Washington State Building Code Council (Chapter 51-47 WAC) for maximum water usage by plumbing fixtures.
- E. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
- F. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
  - 1. Faucets: ASME A112.18.1M.
  - 2. NSF Materials: NSF 61.
  - 3. Pipe Threads: ASME B1.20.1.
  - 4. Supply and Drain Fittings: ASME A112.18.1M.
- G. Comply with the following applicable standards and other requirements specified for miscellaneous fittings and accessories:
  - 1. Brass and Copper Supplies: ASME A112.18.1M.
    - a. Stops: Chrome-plated, quarter-turn ball type; 1/2 inch nominal compression or threaded inlet, with attached lever-handle.
    - b. Supplies: Chrome-plated; flexible tubing riser with ground joint connection to fixture and wall escutcheon.
  - 2. Tubular Brass Drainage Fittings and Piping: ASME A112.18.2M; 17 gauge minimum; semi-cast p-traps with cleanout, 1-1/2" minimum.

## 1.06 COORDINATION

- A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Lavatories, Water Closets, Urinals, Service Sinks:
    - a. Kohler Co.
  - 2. Stainless Steel Sinks and Service Sinks:
    - a. Elkay Mfg. Co.
    - b. Just Mfg. Co.
  - 3. Faucets:
    - a. Chicago Faucet Co.
    - b. Delta Commercial Faucets (lavatory faucets only)
    - c. Elkay Mfg. Co.

### 2.02 PLUMBING FIXTURE SCHEDULE

- A. General: Basis-of-Design manufacturers and model numbers listed are for reference only for intended level of quality and required features.

- B. See Plumbing Fixture Schedule on drawings for specific fixture type and size.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install counter-mounting fixtures in and attached to casework.
- C. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
- D. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- E. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- F. Install protective shielding guards on hot and cold water supplies, stops, p-trap and drain piping for fixtures designated as accessible.
- G. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- H. Install traps on fixture outlets.
- I. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for escutcheons.
- J. Seal joints between fixtures and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

### 3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to sanitary drainage and vent piping.
- D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.
- E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

### 3.04 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

### 3.05 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - 2. Remove sediment and debris from drains.

### 3.06 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00



## SECTION 23 05 00 – GENERAL REQUIREMENTS FOR HVAC

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.
- B. Related Sections include the following:
  - 1. Division 23 Section “Project Closeout for HVAC”.

#### 1.02 SCOPE OF WORK – GENERAL

- A. This section specifies general requirements for HVAC installations and includes requirements common to more than one section of Division 23. It expands and supplements the requirements specified in sections of Division 01.
- B. Provide materials, labor, transportation, tools, permits, fees, inspections, utilities and incidentals necessary for the complete installation of HVAC work indicated and described in the Contract Documents.
- C. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified under this section of work or work specified in other sections, provide material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.

#### 1.03 SEQUENCE OF WORK

- A. Conduct work in sequence to provide least possible interference to the activities of the Owner, and to permit orderly transfer of activities and equipment to completed areas.
- B. Work shall be substantially complete by the dates listed in Division 01 Section “Summary of Work”.

#### 1.04 DEFINITIONS

- A. Provide: Furnish and install complete and ready for intended use.
- B. Indicated: Indicated on drawings.
- C. Noted: Noted on Drawings or in Specifications.
- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

- E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- H. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

#### 1.05 CODES AND STANDARDS

- A. Code Compliance: Comply with most current adopted edition of following:
  - 1. International Building Code (IBC), Standards and Amendments.
  - 2. International Mechanical Code (IMC), Standards and Amendments.
  - 3. International Fire Code (IFC), Standards and Amendments.
  - 4. Uniform Plumbing Code (UPC), Standards and Amendments.
  - 5. National Fire Protection Association (NFPA).
  - 6. National Electrical Code (NEC); NFPA 70.
  - 7. Applicable State and local codes, laws and ordinances.

#### 1.06 SAFETY OF PERSONS AND PROPERTY

- A. Comply with applicable laws, ordinances, rules and regulations of any public authority for the safety of persons and property, including requirements of the Washington Industrial Safety and Health Administration (WISHA) and/or the Occupational Safety and Health Act (OSHA) and Division 01, General and Supplementary Conditions.

#### 1.07 PERMITS AND FEES

- A. Obtain and pay for required permits and fees necessary to fully complete work included in the Contract Documents.

#### 1.08 INTENT AND INTERPRETATION

- A. Drawings and Specifications supplement each other and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.
- B. Drawings are partly diagrammatic and do not necessarily show exact location of new piping and existing utilities, unless specifically dimensioned.
- C. Grilles, fixtures or other pieces of equipment shall be centered on windows, wall spaces, or other items, unless specifically dimensioned otherwise.

- D. Location of piping and ductwork shall be checked to determine that it clears openings and structural members; that it may be properly concealed; and that it clears cabinets, lights and equipment having fixed locations.
- E. Mechanical drawings shall serve as working drawings for Division 23 work. Refer to Architectural and Electrical drawings for additional detail affecting the installation of work. Architectural drawings shall take precedence over the Mechanical drawings if any dimensional discrepancies exist.
- F. Approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details in regard to location. Exact locations are to be determined by actual measurements at the building. Not all pipe and duct offsets are indicated on the drawings.

#### 1.09 SUBMITTAL OF EQUIPMENT FOR APPROVAL

- A. Refer to Division 01 requirements for submittal definitions, requirements and procedures. Additional requirements are listed below.
- B. Shop drawings, catalog information, and material schedules shall be submitted for approval on materials and equipment prior to ordering.
- C. Submittals not meeting the following requirements will be returned for revision:
  - 1. Provide a cover page for each item or group of items (schedule group, single fixture plus trim group, etc.). Cover page shall provide a 3" x 5" space for Engineer's review stamp
  - 2. Each cover page must be clearly identified with the project name, specification number and paragraph number.
  - 3. Submittal package must be accompanied by an itemized index listing specification section, paragraph number, item and manufacturer; larger projects will be index tabbed by specification section with index for each section.

#### 1.10 SCHEDULE OF VALUES

- A. Furnish to the Engineer, a breakdown of the Contract for work in Division 23 within 30 days of Notice to Proceed.
- B. The breakdown shall list cost for materials and labor as follows:
  - 1. Miscellaneous Overhead Expenses
  - 2. HVAC Piping
  - 3. HVAC Ductwork
  - 4. HVAC Equipment
  - 5. HVAC Duct Cleaning
  - 6. HVAC Instrumentation and Controls
  - 7. Testing, Adjusting and Balancing
  - 8. Project Closeout

## 1.11 GUARANTEE

- A. Guarantee satisfactory operation of material and equipment installed under Division 23. Repair or replace any defective materials, equipment, or workmanship which may show itself within one year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. Where more than one manufacturer is listed, provide products of only one manufacturer for each type of product.
- B. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated “new” equipment is not acceptable.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

### 2.02 EQUIPMENT AND MATERIAL SUBSTITUTIONS

- A. Throughout these Contract Documents, various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, type or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of the bid.
- B. Where more than one manufacturer is listed, and only one manufacturer's catalog number is indicated, that standard of quality and construction shall be maintained by materials supplied by other manufacturer(s).
- C. Substitutions of equipment or materials shall be made only with written prior approval. Prior approval requests must be received at least ten (10) days prior to bid date unless otherwise instructed. Refer to Division 01 Section, “Substitution Procedures” for procedures in requesting substitutions. The Owner or Owner’s representative shall review all substitution requests for final approval.
- D. Substitution request must include manufacturer, specific model number, special features, physical dimensions, and capacities of proposed equipment. Verify requirements before submitting for approval.
- E. The Contractor shall bear full responsibility for substituted equipment and materials, including, but not limited to:
  - 1. Costs.
  - 2. Available space requirements
  - 3. Effect on other trades
  - 4. Changes in electrical requirements
  - 5. Changes in structural requirements.

## PART 3 - EXECUTION

### 3.01 COORDINATION

- A. Refer to Division 01 Section "Project Coordination".
- B. Coordinate available space for equipment and systems with other trades. Refer to Architectural and Electrical Drawings for additional building details necessary for coordination.
- C. Cutting, patching, wiring, finishing or any other work required for relocation of work installed due to interferences between work of the various trades will be at no additional cost to the Owner.

### 3.02 MANUFACTURER'S INSTRUCTIONS

- A. Furnish proper equipment and/or materials required for installation as intended by the manufacturer, for all work described under Division 23. If needed for proper installation or operation, request advice and supervisory assistance from the representative of the specific manufacturer. Manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated. Promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and obtain the Architect's instructions before proceeding with the work.

### 3.03 LAYING OUT WORK

- A. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Exact locations of such items shall be determined from the Construction Drawings. Verify physical dimensions of each item of mechanical equipment, ductwork system and piping system, to fit available space and promptly notify the Architect prior to roughing-in if conflicts appear. Coordinate equipment to available space and access routes through construction. Offsets or transitions in ductwork or piping systems required for proper system operation and/or installation, whether indicated on drawings or not, shall be provided at no additional cost to Owner.

### 3.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
- C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.05 ACCESSIBILITY

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate location of concealed equipment and devices requiring access with location of access panels and doors. Allow ample space for removal of parts that require replacement or servicing.

3.06 TEMPORARY USE OF NEW EQUIPMENT

- A. New equipment shall not be used for temporary heating, cooling or ventilation unless authorized in writing by the Owner.

END OF SECTION 23 05 00

## SECTION 23 05 05 – PROJECT CLOSEOUT FOR HVAC

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.
- B. Related Sections include the following:
  - 1. Division 01 Section “Closeout Procedures”.

#### 1.02 SCOPE OF WORK - GENERAL

- A. This section specifies procedural requirements for HVAC installations project closeout, including but not limited to:
  - 1. Project Record Document submittal.
  - 2. Operation and Maintenance Manual submittal.
  - 3. Operation and Maintenance Instruction and Training.
  - 4. HVAC Equipment and Systems Start-Up.
  - 5. Lubrication.
  - 6. Final Cleaning.

#### 1.03 PROJECT RECORD DOCUMENTS

- A. Record differences between HVAC work as installed and as shown in Contract Drawings on a set of prints of HVAC drawings furnished by Architect. Return these prints to Architect at completion of project. Notations made on drawings shall be neat and legible. Comply with Division 01 Section requirements.
- B. Mark drawings to indicate revisions to HVAC piping and ductwork, size and location both exterior and interior; including locations of coils, dampers, and other control devices, filters, motors and similar items requiring periodic maintenance; actual equipment locations; concealed equipment and control devices; mains and branches of piping systems, with valves and control devices located and numbered.
- C. Revise equipment and fixture schedules on the Drawings to indicate actual installed manufacturer and model numbers.
- D. Mark specifications to indicate change orders; actual equipment and materials used.

#### 1.04 OPERATION AND MAINTENANCE MANUALS

- A. Prepare and submit Operation and Maintenance (O&M) Manuals for HVAC systems provided. Comply with Division 01 Section requirements.
- B. Manual binder shall have permanent lettering of a contrasting color. Information to be included on the binder is as follows:
  - 1. The front cover shall be lettered as follows:

HVAC  
OPERATION AND MAINTENANCE

MANUAL

(PROJECT NAME)

(CITY AND STATE)

(YEAR)

OWNER:

(NAME)

ARCHITECT:

(NAME)

MECHANICAL ENGINEER:

L&S ENGINEERING ASSOCIATES, INC.

GENERAL CONTRACTOR:

(NAME)

HVAC CONTRACTOR:

(NAME)

2. The spine shall be lettered as follows:  
HVAC O&M MANUAL (Year)  
(Project Name)
- C. Provide master index at beginning of Manual showing sections and items included. Use plastic tab indexes for sections of Manual.
- D. Cover section: List name, address, and phone number of Project Architect, General Contractor, Mechanical Engineer, HVAC Contractor and all HVAC Sub-Contractors. Provide a list of equipment suppliers with address and phone number.
- E. Provide a separate section for each Section of the Specifications. Provide index for each section listing equipment included. Include all items specified.
- F. Include descriptive literature (manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined. Data sheets shall be originals or clean copies of originals. Copies of faxes are not acceptable. Include copies of approved submittals or shop drawings for all items requiring submittal.
- G. One draft copy of the manual shall be submitted to both the Engineer and Commissioning Authority for review, comment and approval, as applicable, at least 15 days prior to substantial completion or training, whichever is first. After approval, submit 3 copies of manual to Architect for approval unless otherwise directed by Division 01 Section requirements. Information to be included in manual:
  1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
  2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping shut-down, and emergency instructions; and summer and winter operating instructions.



3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
  4. Servicing instructions and lubrication charts and schedules.
  5. Testing, Adjusting and Balancing Report.
  6. Equipment start-up reports.
  7. Warranty information and letters of guarantee.
  8. Instruction period checklist for each equipment item.
- H. Complete O&M Manual shall be available for use by Owner's representatives during instruction and training sessions.

#### 1.05 OPERATION AND MAINTENANCE INSTRUCTION AND TRAINING

- A. Instruct Owner's Representative(s) in the Operation and Maintenance procedures described in Operation and Maintenance Manual. Comply with Division 01 Section requirements.
- B. Enlist services of qualified personnel, including each sub-trade and factory trained specialists for each major piece of equipment, to attend training sessions and provide operation and maintenance instructions.
- C. Sign in sheets shall be used for all attendees, including manufacturer's, vendor's and contractor's personnel.
- D. Provide a minimum of 4 hours instructional time for building operators and/or technical personnel. Refer to individual Division 23 sections for additional instruction/training requirements."
- E. All HVAC systems shall be properly functioning prior to instruction period.

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

#### PART 3 - EXECUTION

##### 3.01 HVAC EQUIPMENT AND SYSTEMS START-UP

- A. Provide the services of a factory-authorized service representative to test and inspect unit installation, provide start-up service and demonstrate and train Owner's maintenance personnel.
- B. Include certification of factory-authorized representative status as part of equipment submittal from manufacturer. Include copies of any installation and start-up instructions, manufacturer's checklists and other forms used in start-up as part of the equipment submittal. Include written start-up reports with test data for equipment in Operation and Maintenance Manual.
- C. All construction debris, including electrical wiring debris shall be removed from units prior to equipment start up. Areas surrounding and served by equipment being started must be free of construction debris, sheetrock dust and any materials that may adversely affect the equipment.

3.02 LUBRICATION

- A. Lubricate all pieces of equipment in accordance with Manufacturer's written instructions prior to project closeout. Include a listing of all equipment with the date of final lubrication in Operation and Maintenance manual.

3.03 FINAL CLEANING

- A. Refer to Division 01 general requirements for final cleaning.
- B. At time of final cleanup, clean all fixtures and equipment and leave in condition for use intended. Vacuum cabinet interiors of control panels, air handling units, etc. to remove all construction debris including electrical wiring debris.

3.04 HVAC EQUIPMENT DATA SHEETS

- A. The following data sheet sample is for reference only. This sample sets the level of completeness required for HVAC equipment records.
- B. Furnish data sheet for each piece of HVAC equipment requiring operation or maintenance or both. Each data sheet be prepared on a single 8.5 by 11 inch sheet suitable for insertion in a three-ring binder. Data sheets shall be completed to the fullest extent possible by the Contractor prior to submission to the Commissioning Authority.
- C. EQUIPMENT DATA SHEET SAMPLE

Equipment Designation	AHU-1		
Equipment Description	Air Handling Unit		
Location	Mechanical Room		
Manufacturer	Carrier Corporation	Model Number	39MXXXXX
Date of Manufacture	March 12, 2006		
Warranty Term	One year		
Vendor	Company name Street Address City, State, ZIP Phone Fax		
Start Up By	Company Name Company Address City, State, ZIP Phone Fax	Start-Up Date	Date
		Performed by	Technician name
O&M Instructions	In Manual		
Spare Parts			
Filter Size(s) and Type:			
Fan Belt(s):			

Motor:	
Mfr./Model/Frame	
Voltage/Amperage/Ph.	

PART 4 - APPENDIX TO SECTION 23 05 05

4.01 GOALS OF THE TRAINING SESSION

- A. Inform maintenance staff of minimum requirements for maintaining equipment installed on this project. Minimum training required to satisfy this goal is listed in Suggested Training Agenda. Additional requirements may apply as appropriate to equipment installed.
- B. In addition to the general goal stated above, the Owner has the following specific goals which the training session must satisfy:
  - 1. Train staff how to replace filters.
  - 2. Train staff how to respond to alarms generated by the controls system.
  - 3. Train maintenance staff regarding standard operating parameters of equipment.
  - 4. Train maintenance staff regarding the potential failure modes of equipment and appropriate actions to take should such failures occur.
  - 5. Train Administrative staff how to adjust temperature settings, where appropriate.
- C. Personnel who will be attending the training session are varied. Contractor should design the training session as appropriate to audience as listed below:
  - 1. Maintenance Staff
    - a. These personnel have several years experience in maintaining systems similar to those used in this project. General training session should be provided as a refresher course in system maintenance requirements.
    - b. Beyond the understanding general system requirements, individuals should be able to identify specific maintenance requirements of particular equipment used on this project.
    - c. At end of the training session, the maintenance staff should be able to prepare a maintenance schedule, based on information provided in this training program.
  - 2. Administrative Staff
    - a. These personnel have little or no experience operating systems of the kind used on this project.
    - b. Training for these individuals should consist of instruction regarding normal operating procedures; what systems should be expected to do; what systems should not be expected to do.
    - c. At the end of training session, these individuals should be able to respond to comfort complaints and emergencies by making minor adjustments or by contacting appropriate maintenance personnel.

END OF SECTION 23 05 05

## SECTION 23 05 07 – HVAC DEMOLITION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.
- B. Related Sections include the following:
  - 1. Division 01 Section “Cutting and Patching”.
  - 2. Division 01 Section “Selective Demolition” for general demolition requirements and procedures.

#### 1.02 SUMMARY

- A. Include all labor, equipment, and materials necessary to complete demolition of existing HVAC systems as shown on the drawings and described herein.
- B. Mechanical Services to areas occupied by Owner shall be maintained.

#### 1.03 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

### PART 2 - SALVAGE

#### 2.01 MATERIALS OWNERSHIP

- A. The Owner shall have first salvage rights to all removed fixtures and equipment. Coordinate selection with the Owner's Representative.
- B. Except for items or materials to be reused, salvaged, reinstalled or otherwise indicated to remain owner's property, demolished materials shall become Contractor's property and removed from Project site.

- C. Transport and legally dispose of off-site, all materials resulting from demolition not being salvaged.

### PART 3 - EXECUTION

#### 3.01 DEMOLITION

- A. Condition and Premises: The Owner assumes no responsibility for condition of areas to be demolished. General conditions existing at time of inspection for bidding purposes will be maintained by Owner.
- B. Partial Removal: Items of salvageable value to Contractor indicated to be removed may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage or sale of removed items on site will not be permitted.
- C. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.
- D. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.
- E. Existing Utility Services: Maintain existing utilities indicated to remain, keep in service and protect against damage during demolition operations.
- F. Not all piping, ductwork or equipment items are shown on drawings. Other demolition may be required.
- G. Any existing ductwork or piping that is to be reused or left in existing position shall have the opening of such covered and protected during demolition and construction until final connections can be made.
- H. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
  - 1. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - 2. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment. Equipment removal shall include removal of all connecting piping, ductwork, etc., either to a point below floor behind wall surface, etc.
  - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

- I. If pipe, insulation, or equipment to remain is damaged in appearance during construction, or is rendered unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

END OF SECTION 23 05 07

## SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC PIPE AND EQUIPMENT

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes hangers and supports for HVAC piping and equipment.
- B. Related Sections include the following:
  - 1. Division 23 Section “Metal Ducts” for duct hangers and supports.

#### 1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.04 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Pipe Hangers:
    - a. Anvil International, Inc.
    - b. Globe Pipe Hanger Products, Inc.
    - c. Erico/Michigan Hanger Co., Inc.
    - d. PHD Manufacturing, Inc.
    - e. Thomas & Betts
    - f. Tolco Inc.
    - g. Unistrut Corp.

## 2.02 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
  - 1. Galvanized, Metallic Coatings: Galvanized or hot dipped.
  - 2. Nonmetallic Coatings: Plastic coating, jacket or liner.

## 2.03 MISCELLANEOUS MATERIALS

- A. Mechanical-Anchor Fasteners:
  - 1. Type 304 stainless steel hollow-set drop-in internally threaded expansion anchor.
  - 2. Manufactured by Powers Fasteners, Red Head, Hilti or approved equal.

## PART 3 - EXECUTION

### 3.01 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
  - 2. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
  - 3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  - 4. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
- F. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.



- G. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. Mechanical Expansion Insert: For upper attachment to suspend pipe hangers from concrete ceiling.
  - 2. Insert as recommended by manufacturer to a minimum depth of one inch.
  - 3. Drill hole for insert at center line of concrete hollow core. Do not extend into core.

### 3.02 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Install mechanical-anchor fasteners in according to manufacturer's written instructions.
- C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units. Make allowance for pipe insulation as required.
- E. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- F. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- G. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield with clamp sized to match OD of insulation.
    - c. Do not exceed pipe stress limits according to ASME B31.9.
  - 2. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
  - 3. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

### 3.03 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

END OF SECTION 23 05 29

## SECTION 23 05 48 -VIBRATION CONTROLS FOR HVAC EQUIPMENT

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and as provisions of the Contract. The General Conditions, Supplementary General Conditions, Special Conditions, and other Division 0 and 1 Specification Sections apply to the Work of this Section.

#### 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Elastomeric hangers
  - 2. Elastomeric base pads.

#### 1.03 SUBMITTALS

- A. Product Data: For the following:
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

### PART 2 - PRODUCTS

#### 2.01 VIBRATION ISOLATION SCHEDULE

- A. Provide the following vibration isolators and bases for mechanical equipment and systems:
  - 1. Ceiling Mounted Air Handler: AHU-1
    - a. Isolators: Elastomeric hanger and flexible duct connection at unit.
  - 2. Air-Cooled, Split-system Condensing Units: AC-1
    - a. Isolators: Elastomeric isolation pads, Type 1.

#### 2.02 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed.

#### 2.03 VIBRATION ISOLATORS

- A. Manufacturers:
  - 1. Amber/Booth Company, Inc.
  - 2. Kinetics Noise Control, Inc.
  - 3. Mason Industries, Inc.
  - 4. MW Sausse.

5. Vibro-Acoustics.
  6. Vibration Eliminator Co., Inc.
  7. Vibration Mountings & Controls/Korfund.
- B. Elastomeric Isolator Pads (Isolator Type 1): Oil- and water-resistant elastomer; crossed, double ribbed pads, molded with a nonslip pattern; and factory cut to sizes that match requirements of supported equipment.
1. Material: Standard neoprene or natural rubber.
  2. Thickness: 3/4-inch minimum.
  3. Minimum Deflection: 0.15-inches.
  4. Durometer Rating: 45 to 65.
  5. Maximum load: 50 psi.
  6. Number of Layers: 1 unless otherwise noted or bonded to steel plate for proper load distribution
  7. Acceptable Products:
    - a. Model Super W by Mason
    - b. Model RSP by Kinetics
    - c. Model ECPR by Caldyn
- C. Elastomeric Hangers (Isolator Type 2): Neoprene or Fiberglass Hanger
1. Hangers to consist of a neoprene-in-sheer or fiberglass isolator encased in a welded steel bracket.
  2. Hangers to have a minimum operating static deflection of 0.25 inch.
  3. Acceptable Products:
    - a. Model HD by Mason
    - b. Model FH by Kinetics
    - c. Model RH by Caldyn
    - d. Model HRD by Amber Booth

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 INSTALLATION

- A. Install vibration-isolation devices using methods approved by an evaluation service member of ICC-ES providing required submittals for components.

#### 3.03 ADJUSTING

- A. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

3.04 CLEANING

- A. After completing equipment installation, inspect vibration isolation devices. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION 23 05 48

## SECTION 23 05 93 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
  - 1. Air Systems:
    - a. Rebalance existing constant-volume air systems.
    - b. Balance CAD/AVL room ceil mounted air handler.
    - c. Set variable-volume diffuser system.
  - 2. HVAC equipment quantitative-performance settings.
  - 3. Verifying that automatic control devices are functioning properly.
  - 4. Reporting results of activities and procedures specified in this Section.

#### 1.03 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- E. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- F. Report Forms: Test data sheets for recording test data in logical order.
- G. TAB: Testing, adjusting, and balancing.
- H. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- I. Test: A procedure to determine quantitative performance of systems or equipment.

- J. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures

#### 1.04 SUBMITTALS

- A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3.
- C. Certified TAB Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

#### 1.05 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.
  - 1. Approved TAB Firms:
    - a. Maiani Construction Services
    - b. TestComm, LLC
- B. TAB Conference: 30 days prior to scheduled TAB activities, meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.
  - 1. Agenda Items: Include at least the following:
    - a. TAB plan.
    - b. Work schedule and Project-site access requirements.
    - c. Coordination and cooperation of trades and subcontractors.
    - d. Coordination of documentation and communication flow.
- C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- D. Instrumentation Calibration: Calibrate instruments in accordance with AABC or NEBB requirements.
- E. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration

#### 1.06 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

#### 1.07 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days advance notice for commencement of TAB activities.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed, HVAC units and other equipment properly started, and unit controls operational.

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

#### PART 3 - EXECUTION

##### 3.01 EXAMINATION

- A. Verify that systems are complete and operational before commencing TAB work. Ensure the following conditions are met:
  - 1. All 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 and free of debris.
  - 6. Fans are rotating correctly.
  - 7. 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. TAB technician shall complete a NEBB "System Ready to Balance Pre-TAB Checklist" (or equivalent) prior to starting the TAB activities

##### 3.02 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Cut insulation, ducts and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.



- B. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, fan-speed-control levers, and similar controls and devices, to show final settings.

### 3.03 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Determine best locations in main and branch ducts for accurate duct airflow measurements.
- C. Check airflow patterns from outside-air louvers and dampers and return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check dampers for proper position to achieve desired airflow path.
- G. Check for airflow blockages.
- H. Check condensate drains for proper connections and functioning.
- I. Check for proper sealing of air-handling unit components.
- J. Check for proper sealing of air duct system.
- K. Measure and calibrate airflow monitoring devices.

### 3.04 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: +/- 10 percent.
  - 2. Air Outlets and Inlets: +/- 10 percent

### 3.05 REPORTING

- A. The TAB firm shall report progress to the Architect, Owner and Contractor weekly once TAB is started, and list any deficiencies noted at that time.

### 3.06 FINAL REPORT

- A. General: Computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of the instruments used for procedures, along with proof of calibration.
- C. Preliminary Review Report: Submit two (2) draft copies of Preliminary Balance Report for review prior to submission of Final Report.
- D. Final Report Contents: In addition to the certified field report data, include the following:
  - 1. Fan curves.
  - 2. Manufacturers' test data.
  - 3. Field test reports prepared by system and equipment installers.
  - 4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
- E. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
  - 1. Title page.
  - 2. Name and address of TAB firm.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB firm who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page of the report.
  - 11. Summary of contents, including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 12. Nomenclature sheets for each item of equipment.
  - 13. Data for terminal units, including manufacturer, type size, and fittings.
  - 14. Notes to explain why certain final data in the body of reports vary from design values.
  - 15. Test conditions for forms to including the following:
    - a. Settings for outside-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Fan drive settings, including settings and percentage of maximum pitch diameter.
    - d. Other system operating conditions that affect performance.
- F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
  - 1. Unit Data: Include the following:
    - a. Unit identification.

- b. Location.
  - c. Make and type.
  - d. Model number and unit size.
  - e. Manufacturer's serial number.
  - f. Unit arrangement and class.
  - g. Discharge arrangement.
  - h. Sheave make, size in inches, and bore.
  - i. Sheave dimensions, center-to-center, and amount of adjustments in inches.
  - j. Number of belts, make, and size.
  - k. Number of filters, type, and size.
2. Motor Data:
    - a. Make and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
  3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Filter static-pressure differential in inches wg.
    - f. Outside airflow in cfm.
    - g. Return airflow in cfm.
    - h. Outside-air damper position.
    - i. Return-air damper position.
- G. Apparatus-Coil Test Reports:
1. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm.
    - b. Average face velocity in fpm.
    - c. Air pressure drop in inches wg.
    - d. Entering-air, wet- and dry-bulb temperatures in deg F.
    - e. Leaving-air, wet- and dry-bulb temperatures in deg F.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Motor Data:
    - a. Make and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
    - g. Number of belts, make, and size.
  3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Suction static pressure in inches wg.
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
    - a. System and air-handling unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft.
    - g. Indicated airflow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual airflow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
- J. Instrument Calibration Reports:
1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

END OF SECTION 23 05 93

## SECTION 23 07 00 – HVAC INSULATION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes insulation systems for HVAC ductwork.
- B. Related Sections include the following:
  - 1. Division 23 Section "Metal Ducts" for duct liners.

#### 1.03 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. PVC: Polyvinyl chloride.
- D. SSL: Self-sealing lap.

#### 1.04 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. For adhesives, sealants and mastics: Documentation including printed statement of VOC content.

#### 1.05 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Thermal conductivity (k-value) not greater than 0.27 at 75 deg F mean temperature.
  - 1. Products:
    - a. Aeroflex USA Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. Nomaco K-Flex.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
  - 1. Products:
    - a. CertainTeed Corp.; Duct Wrap.

- b. Johns Manville; Microlite.
- c. Knauf Insulation; Duct Wrap.
- d. Manson Insulation Inc.; Alley Wrap.
- e. Owens Corning; All-Service Duct Wrap.

## 2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  - 4. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
  - 1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 200 deg F.
  - 3. Solids Content: 63 percent by volume and 73 percent by weight.
  - 4. Color: White.

## 2.05 SEALANTS

- A. Joint Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 3. Color:
    - a. White for ASJ and PVC.
    - b. Aluminum for FSK and metal jackets.
- B. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.06 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.07 TAPES

- A. ASJ Tape: White vapor-barrier tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
- B. FSK Tape: Foil-face, vapor-barrier tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
- C. PVC Tape: White vapor-barrier tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
- D. Aluminum-Foil Tape: Vapor-barrier tape with acrylic adhesive and UL listed.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.03 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or barriers, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.



- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 to 6 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. Do not install insulation to the following:
  - 1. Testing agency labels and stamps.
  - 2. Nameplates and data plates.

### 3.04 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Non-Rated Interior Wall and Partition Penetrations): Install insulation continuously through walls and partitions.

### 3.05 MINERAL-FIBER INSULATION INSTALLATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Where required or recommended by manufacturer, apply adhesives according to recommended coverage rates per unit area for duct and plenum surfaces. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 2. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on bottom of rectangular or square ducts as follows:
    - a. On duct bottoms with dimensions 18-inches and larger, place pins spaced 3 inches maximum from insulation end joints, and 18-inches o.c. Install additional pins to hold insulation tightly against surface at cross bracing.
  - 3. Apply insulation with edges tightly secured with staples at 6-inch maximum spacing. Tape secured seam with 3-inch wide pressure-sensitive aluminum foil tape or seal joints with two coats of vapor barrier mastic reinforced with one layer of open weave glass fabric as recommended by manufacturer.
  - 4. Do not overcompress insulation during installation.
  - 5. Cut excess portion of pins extending beyond speed washers. Cover exposed pins and washers with tape matching insulation facing to maintain vapor barrier seal.

### 3.06 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  - 1. Indoor, concealed supply, return and outdoor air.
  - 2. Indoor, exposed supply, return and outdoor air.
- B. Items Not Insulated:
  - 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
  - 2. Factory-insulated flexible ducts.
  - 3. Factory-insulated plenums and casings.
  - 4. Flexible connectors.
  - 5. Vibration-control devices.
  - 6. Factory-insulated access panels and doors.
  - 7. Exposed branch return air ductwork from air inlet to point of connection to main duct.

### 3.07 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. If more than one material is listed, selection from materials listed is Contractor's option.
- B. Service: Supply-air, within conditioned space.
  - 1. Material: Mineral-Fiber Board or Mineral-Fiber Blanket.
  - 2. Minimum R-value: R-3.3.
  - 3. Field-Applied Jacket: None.
  - 4. Vapor Barrier Required: Yes.
- C. Service: Outside-air ducts, within conditioned space.
  - 1. Material: Mineral-Fiber Board or Mineral-Fiber Blanket.
  - 2. Minimum R-value: R-7.
  - 3. Field-Applied Jacket: None.
  - 4. Vapor Barrier Required: Yes.

### 3.08 PIPING INSULATION SCHEDULE, GENERAL

- A. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Fire-suppression piping.
  - 2. Drainage piping located in crawl spaces.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.09 INDOOR PIPING INSULATION SCHEDULE

- A. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Service: Refrigerant Suction.
  - 1. Operating Temperature: 35 to 50 deg F.
  - 2. Insulation Material: Flexible Elastomeric.

3. Insulation Thickness: Apply the following insulation thicknesses:
  - a. All pipe sizes: 0.5 inch
4. Field-Applied Jacket: None.

### 3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Service: Refrigerant Suction.
  1. Operating Temperature: 35 to 50 deg F.
  2. Insulation Material: Flexible Elastomeric.
  3. Insulation Thickness: Apply the following insulation thicknesses:
    - a. All pipe sizes: 0.5 inch i.d.
    - b. Field-Applied Jacket: Aluminum.
    - c. Vapor Barrier Required: None.

END OF SECTION 23 07 00

## SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. General: The control system shall consist of:
  1. Relocating and re-using the existing room temperature sensor to serve the rooms supplied by the existing rooftop air handler and duct system.
  2. The Dispatch Office shall be provided with a variable air volume diffuser that will be controlled through a wall mounted room temperature sensor and damper mounted controls, supplied by the damper manufacturer and installed under this section of the specifications. Reference specification section 23 37 13 for information on this system. 24 volt power for the temperature sensor and control system shall provide under this section of the specifications.
  3. The new split system air handler for the CAD/AVL room will be controlled by a unit mounted programmable microprocessor and a wall mounted user interface display provided with the air handling equipment. An electronic timer shall activate the outside air supply duct's damper associated with the air handler. The timer, damper and actuator shall be provided under this section of specifications. Reference specification section 23 81 27 for information on split system's control unit.

#### 1.03 RELATED SECTIONS

- A. Related Sections include the following:
  1. Division 23 Section "Testing, Adjusting and Balancing for HVAC" for requirements that relate to this Section.
  2. See specification sections 23 37 13, (Diffusers, Registers, and Grilles) and 23 81 27 (Computer Room Split Air-conditioning System) for control component supplier and manufacturer.

#### 1.04 QUALITY ASSURANCE

- A. Installer and Manufacturer Qualifications
  1. Installer shall have an established working relationship with Control System Manufacturer and shall have an office located within 40 miles of the project.
  2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

## 1.05 CODES AND STANDARDS

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
1. National Electric Code (NEC)
  2. International Building Code (IBC)
  3. International Mechanical Code (IMC)
  4. ANSI/ASHRAE 135-2008: Data Communication Protocol for Building Automation and Control Systems (BACnet)

## 1.06 SUBMITTALS

- A. Product Submittal Requirements: Meet requirements of Division 1 on Shop Drawings, Product Data, and Samples. When manufacturer's cutsheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Provide submittals on the following:
1. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
    - a. Actuators
    - b. Control dampers
    - c. Power supplies
    - d. Electronic timers

## 1.07 WARRANTY

- A. All systems, sub-systems, component parts, and software shall be fully free from defective design, materials, and workmanship for a period of one year from the date of final acceptance.
- B. Include a minimum of four (4) hours additional programming for changes as directed during the warranty period, travel time not included.
- C. Preventive Maintenance: During the warranty period, provide all maintenance at no additional charge. This shall include all parts, labor, and related expenses for correction of the deficiency or breakdown and for routine preventive maintenance.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Spare parts shall be available for at least five years after completion of this contract.

## 2.02 INPUT AND OUTPUT INTERFACE

- A. General. Hard-wire input and output points to controllers.
- B. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.

## 2.03 POWER SUPPLIES AND LINE FILTERING

- A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
  - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
    - a. Unit shall operate between 32°F and 120°F. EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
    - b. Line voltage units shall be UL recognized and CSA listed.

## 2.04 ACTUATORS

- A. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
- B. Quality Assurance:
  - 1. ISO 9001 manufacturer certification.
  - 2. Two year unconditional warranty from date of installation.
  - 3. Underwriter's Laboratories (UL) Listed, Standard 873.
- C. Manufacturers:
  - 1. Belimo only
- D. Applications:
  - 1. Outside air damper: 24 volt, two position, on/off, spring return.
- E. Damper actuator characteristics:
  - 1. Actuators used near outdoor airstreams shall have NEMA type 2 housings. Use additional clear plastic enclosure weather shield to protect actuator when mounted outside.
  - 2. Mechanical spring-return shall be provided when specified. Capacitors or other non-mechanical forms of fail-safe return are not acceptable. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the controlled device as required.
  - 3. Position indicator device shall be installed and made visible to the exposed side of the actuator. For damper short shaft mounting, a separate indicator shall be provided to the exposed side of the actuator.

4. Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation or use of magnetic clutches are not acceptable.
5. A push button gearbox release shall be provided for all non-spring actuators.
6. Damper Actuators:
  - a. Electric damper actuators shall be direct shaft mounted.
  - b. Provide mechanical spring-return on outside-air damper.
  - c. Size for running torque calculated as follows:
    - 1) Parallel-Blade Damper with Edge Seals: 7 inch-pounds/sq. ft. of damper.

## 2.05 CONTROL DAMPERS

- A. General: Size and furnish all automatic control dampers unless provided with packaged equipment.
  1. Dampers for two-position or open-close control shall be parallel blade type arranged for normally-open or normally-closed operation as required.
  2. Damper linkage hardware shall be constructed of aluminum or corrosion resistant zinc and nickel-plated steel. Furnish bearing support bracket and drive blade pin extension for field-mounting on each damper section.
- B. Dampers: AMCA-rated, 13 gage minimum, galvanized-steel frames with holes for duct mounting; damper blades shall not be less than 16 gage galvanized steel with maximum blade width of 8 inches.
  1. Blades shall be secured to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
  2. Operating Temperature Range: From minus 40 to plus 200 deg F.
  3. For standard applications, include optional closed-cell neoprene edging.
  4. For low-leakage applications, use dampers with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4 inches wg when damper is being held by torque of 50 in. x lbf; when tested according to AMCA 500D.

## 2.06 ELECTRONIC TIMER

- A. General: Provide single channel electronic time switch with 24-hour/7-day programmable applications and LCD display. Unit shall have battery backup for program storage.
- B. Manufacturers:
  1. Grasslin, FM1D20 Series
  2. Approved Equal
- C. Supply voltage: 24 volt
- D. Amperage Rating: 8
- E. Warranty: 1 year



## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.
- B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.
- C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate Section 23 09 00 work with work of others. Controls Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies

### 3.02 PROTECTION

- A. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.
- B. Controls Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects

### 3.03 COORDINATION

- A. Site:
  - 1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
  - 2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.
- B. Test and Balance:
  - 1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
  - 2. Train Test and Balance Contractor to use control system interface tools.
  - 3. Provide a qualified technician to assist with testing and balancing for a representative number of terminal units.
  - 4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.
- C. Coordination with Other Controls: Integrate with and coordinate controls and control devices furnished or installed by others as follows.
  - 1. Communication media and equipment shall be provided as specified in Section 23 09 00 Article "Communication".

2. Each supplier of a controls product shall configure, program, start up, and test that product to meet the specified requirements regardless of where within the contract documents those products are described.
  3. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
  4. Controls Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.
- D. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- E. Coordinate installation of control dampers according to Division 23 Section "Air Duct Accessories."

### 3.04 GENERAL WORKMANSHIP

- A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.
- B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.
- C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.
- D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.
- E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

### 3.05 FIELD QUALITY CONTROL

- A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 23 09 00 Article "Codes and Standards".
- B. Continually monitor field installation for code compliance and workmanship quality.
- C. Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

### 3.06 WIRING

- A. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations. Where the requirements of Section 23 09 00 differ from Division 26, Section 23 09 00 shall take precedence.
- B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 26.

- C. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.
- D. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.
- E. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 10 ft. intervals.
- F. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.
- G. Use YSD standards for color-coded conductors throughout.
- H. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

### 3.07 COMMUNICATION WIRING

- A. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article "Wiring".
- B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.
- C. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.
- D. Verify entire network's integrity following cable installation using appropriate tests for each cable.
- E. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.
- F. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.
- G. Label communication wiring to indicate origination and destination.
- H. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."
- I. Plenum cable shall be run as high as possible to prevent damage.
- J. Class 2 cables shall be installed in raceway in walls, floors, and above inaccessible ceilings. Terminate raceway 12-inches above ceiling level for partial height walls; terminate raceway with 90 degree sweep, 12-inches above ceiling level for full height walls. Raceway routing shall provide for the shortest possible cable length along lines parallel and perpendicular with building lines.

- K. Cables installed in free air above accessible ceilings shall be supported by 2-inch J-hooks, 2-inch D-rings and/or cable tray. J-hooks and D-rings shall be spaced 48-inches apart. Where required, use structural members to support or anchor plenum cables without raceway. Do not use ductwork, raceways, piping, or ceiling suspension systems to support or anchor cables. Plastic tie wraps for support are not acceptable. Cable sag between supports shall be 4-inches minimum and 8-inches maximum. Runs of J-hooks or D-rings shall be installed along lines parallel and perpendicular with building lines. Physically separate Class 2 DDC cables from all other cables installed in cable tray.
- L. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
- M. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors. Tie and support conductors with nylon tie-supports, Panduit Model TM2S8-C or equal.

### 3.08 INSTALLATION OF SENSORS

- A. Install sensors according to manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for operating environment.
- C. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation. Locate sensors with adjustable setpoints and/or override buttons 48 inches above finished floor. Locate all other sensors or devices 60 inches above finished floor.

### 3.09 ACTUATORS

- A. General. Mount actuators and adapters according to manufacturer's recommendations.
- B. Electric and Electronic Damper Actuators. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation. Link actuators according to manufacturer's recommendations.
  - 1. For low-leakage dampers with seals, mount actuator with a minimum 5° travel available for damper seal tightening.
  - 2. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, then tighten linkage.
  - 3. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
  - 4. Provide necessary mounting hardware and linkages for actuator installation.

### 3.10 ELECTRONIC TIMER

- A. Mount timer on ductwork next to actuator being served in location that accommodates ease of access for programming and view of LCD screen.
- B. Program timer for each day of week in accordance with Owner's requested operating time periods.
- C. Check operation of timer and operation of damper.

### 3.11 CONTROL SYSTEM CHECKOUT AND TESTING

- A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.
  - 1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 23 09 00.
  - 2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
  - 3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
  - 4. Verify that binary output devices such as relays, solenoid valves, two-position actuators, and magnetic starters, operate properly and that normal positions are correct.
  - 5. Alarms and Interlocks.
    - a. Check each alarm with an appropriate signal at a value that will trip the alarm.
    - b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
    - c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

### 3.12 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

- A. Demonstration. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to tests specified in Article "Control System Checkout and Testing".
  - 1. Engineer will be present to observe and review system demonstration. Notify Engineer at least 10 days before system demonstration begins.
  - 2. Demonstrate compliance with Section 23 09 00 Article "System Performance".
  - 3. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.
- B. Acceptance.
  - 1. After tests described in this specification are performed to the satisfaction of both Engineer and Owner, Engineer will accept control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond Contractor's control. Engineer will provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.

### 3.13 CLEANING

- A. Each day clean up debris resulting from work. Remove packaging material as soon as its contents have been removed. Collect waste and place in designated location.
- B. On completion of work in each area, clean work debris and equipment. Keep areas free from dust, dirt, and debris.

- C. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent areas.

### 3.14 TRAINING

- A. Provide training for a designated staff of Owner's representatives. Provide at least 4 hours of instructor based training for building operators.
- B. Training shall enable students to accomplish the following objectives.
  - 1. Proficiently operate system
  - 2. Understand control system architecture and configuration
  - 3. Access point reports, and logs
  - 4. Adjust and change system setpoints, time schedules, and holiday schedules
  - 5. Understand job layout and location of control components
  - 6. Add new users and understand password security procedures
- C. Instructors shall be factory-trained and experienced in presenting this material.

END OF SECTION 23 09 00

## SECTION 23 23 00 - REFRIGERANT PIPING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

#### 1.03 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-22:
  - 1. Suction Lines for Air-Conditioning Applications: 185 psig (1276 kPa).
  - 2. Suction Lines for Heat-Pump Applications: 325 psig (2241 kPa).
  - 3. Hot-Gas and Liquid Lines: 325 psig (2241 kPa).
- B. Line Test Pressure for Refrigerant R-134a:
  - 1. Suction Lines for Air-Conditioning Applications: 115 psig (793 kPa).
  - 2. Suction Lines for Heat-Pump Applications: 225 psig (1551 kPa).
  - 3. Hot-Gas and Liquid Lines: 225 psig (1551 kPa).
- C. Line Test Pressure for Refrigerant R-407C:
  - 1. Suction Lines for Air-Conditioning Applications: 230 psig (1586 kPa).
  - 2. Suction Lines for Heat-Pump Applications: 380 psig (2620 kPa).
  - 3. Hot-Gas and Liquid Lines: 380 psig (2620 kPa).
- D. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).
  - 2. Suction Lines for Heat-Pump Applications: 535 psig (3689 kPa).
  - 3. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

#### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
  - 1. Filter dryers.
  - 2. Strainers.
  - 3. Pressure-regulating valves.

- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
  - 1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

#### 1.06 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

#### 1.07 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

#### 1.08 COORDINATION

- A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations.

### PART 2 - PRODUCTS

#### 2.01 COPPER TUBE AND FITTINGS

- A. Drawn-Tempered Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

#### 2.02 VALVES AND SPECIALTIES

- A. Service Valves:
  - 1. Body: Forged brass with brass cap including key end to remove core.
  - 2. Core: Removable ball-type check valve with stainless-steel spring.
  - 3. Seat: Polytetrafluoroethylene.



4. End Connections: Copper spring.
  5. Working Pressure Rating: 500 psig (3450 kPa).
- B. Moisture/Liquid Indicators:
1. Body: Forged brass.
  2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
  3. Indicator: Color coded to show moisture content in ppm.
  4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
  5. End Connections: Socket or flare.
  6. Working Pressure Rating: 500 psig (3450 kPa).
  7. Maximum Operating Temperature: 240 deg F (116 deg C).
- C. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
  2. Working Pressure Rating: 500 psig (3450 kPa).
  3. Maximum Operating Temperature: 240 deg F (116 deg C).

## 2.03 REFRIGERANTS

- A. ASHRAE 34, R-22: Monochlorodifluoromethane.
- B. ASHRAE 34, R-134a: Tetrafluoroethane.
- C. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.
- D. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

## PART 3 - EXECUTION

### 3.01 VALVE AND SPECIALTY APPLICATIONS

- A. Install service valves for gage taps at inlet and outlet of strainers if they are not an integral part of valves and strainers.

### 3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install refrigerant piping in protective conduit where installed belowground.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

### 3.03 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

### 3.04 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
  - 2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
  - 2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
  - 3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).

### 3.05 PIPE ANCHORS

- A. Securely anchor refrigerant piping where it enters into core drilled hollow plank floor and roof decking to prevent pipe movement and so that piping does not come in contact with building structural components.
  - 1. Provide cold-formed steel channel, designed to support associated pipe clamp, anchored to the structure, manufactured by Unistrut, Tolco or equal.
  - 2. Provide cushioned clamp provided by manufacturer of support strut.
    - a. Carbon steel clamp.
    - b. Thermoplastic elastomer cushion designed to withstand oil, chemicals and industrial cleaning compounds.
    - c. Designed for temperature range of -50°F to 275°F.

### 3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
  - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    - a. Fill system with nitrogen to the required test pressure.
    - b. System shall maintain test pressure at the manifold gage throughout duration of test.
    - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

- d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

### 3.07 SYSTEM CHARGING

- A. Charge system using the following procedures:
  1. Install core in filter dryers after leak test but before evacuation.
  2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
  3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
  4. Charge system with a new filter-dryer core in charging line.

END OF SECTION 23 23 00

## SECTION 23 31 13 – METAL DUCTS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2-inch to plus 10-inch wg. Metal ducts include the following:
  - 1. Rectangular ducts and fittings.
  - 2. Single-wall, round, and flat-oval ducts and formed fittings.
  - 3. Duct liner.
  - 4. Adhesives, sealants and mastics: Documentation including printed statement of VOC content.
  - 5. Cleaning of existing ductwork systems.
- B. Related Sections include the following:
  - 1. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors, turning vanes, and flexible ducts.

#### 1.03 QUALITY ASSURANCE

- A. NFPA Compliance:
  - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
  - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

#### 1.04 DEFINITIONS

- A. NAIMA: North American Insulation Manufacturers Association.
- B. SMACNA: Sheet Metal and Air Conditioning Contractors National Association.

#### 1.05 SUBMITTALS

- A. Product Data: For the following:
  - 1. Single-wall, round, and flat-oval spiral-seam ducts and formed fittings.
  - 2. Duct liner.
  - 3. Adhesives, sealants and mastics: Documentation including printed statement of VOC content.
- B. Shop Drawings: Show fabrication and installation details for metal ducts.
  - 1. Fittings.

2. Reinforcement and spacing.
3. Seam and joint construction.
4. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.

## PART 2 - PRODUCTS

### 2.01 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation. Where specifically indicated, ducts shall have "galvaneal" ("paint-grip") finish for surfaces to be painted.
- C. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.

### 2.02 DUCT LINER

- A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.
  1. Manufacturers:
    - a. CertainTeed Corp.; Insulation Group; "ToughGard2" or "ToughGard R" Duct Liner.
    - b. Johns Manville International, Inc.; "Linacoustic RC" Duct Liner.
    - c. Johns Manville International, Inc.; "Spiracoustic Plus", "Spiracoustic" Round Duct Liner.
    - d. Knauf Fiber Glass GmbH.; "Duct Liner E-M".
    - e. Owens Corning.; "QuietR" Duct Liner.
  2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated with tightly bonded non-woven mat to prevent erosion of glass fibers and to facilitate duct cleaning.
    - a. Thickness: 1 inch unless otherwise indicated.
    - b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
    - c. Anti-Bacterial and Fungal Prevention: EPA-registered anti-microbial agent treatment in airstream surfaces applied to aid in the prevention of fungal and bacterial growth. Comply with ASTM C 1338, ASTM G21, ASTM G22.
    - d. Maximum Emissions Levels:
    - e. Formaldehyde: 0.05 ppm
    - f. Total Volatile Organic Compounds (TOVC): 0.50 mg/m<sup>3</sup>
    - g. Total Particles: 0.05 mg/m<sup>3</sup>
    - h. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.

- i. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
  - 1) VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- j. Mechanical Fasteners: Galvanized steel suitable for welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
  - 1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
  - 2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
  - 3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

## 2.03 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
- B. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  - 1. VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
  - 1. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
  - 1. VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
  - 1. VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.04 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
  - 1. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
  - 2. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

## 2.05 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
  - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
  - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," using corner, bolt, cleat, and gasket details.
- D. Duct Dimensions: Unless specifically indicated, duct dimensions on the Drawings are net free areas. Increase duct dimensions as necessary to compensate for liner thickness.
- E. Elbow Configuration:
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows." Rectangular duct elbow configuration shall be one of the following types unless specifically indicated otherwise:
    - a. Radius Type RE 1 with minimum 1.5 radius-to-width (R/W) ratio. Square throat radius elbows (R/W ratio of 0.5) are not allowed.
    - b. Mitered Type RE 2 with turning vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
      - 1) Exception: Vanes not required for general purpose exhaust-air, return-air, and relief-air ducts where duct velocity is 1000 fpm or lower AND duct net inside area is 144 sq. in. (1.0 sq. ft.) or less.



- F. Branch Configuration:
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection." Rectangular duct branch configuration shall be one of the following types unless specifically indicated otherwise:
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
    - b. Rectangular Main to Round Branch: Spin-in or self-sealing fitting.

## 2.06 APPLICATION OF LINER IN RECTANGULAR DUCTS

- A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
- B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
- E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.
- F. Apply adhesive coating on longitudinal seams in ducts where air velocities are greater than 2500 fpm.
- G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
- H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
  - 1. Fan discharges.
  - 2. Intervals of lined duct preceding unlined duct.
  - 3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm or where indicated.

## 2.07 ROUND DUCT AND FITTING FABRICATION

- A. Duct Dimensions: Unless specifically indicated, duct dimensions on the Drawings are net free areas. Increase duct dimensions as necessary to compensate for liner thickness.
- B. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

- C. Manufacturers:
  - 1. Accu Duct Mfg.
  - 2. Ductmate Industries, Inc.
  - 3. Lindlab, Inc.
  - 4. Semco Mfg., Inc.
  - 5. Spiral Pipe of Texas
  - 6. United Sheet Metal Div. United McGill Corp.
  - 7. Ventline, Inc.
- D. Duct Joints:
  - 1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
  - 2. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
- E. Tees and Lateral Taps: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- F. Elbow Configuration:
  - 1. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
    - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      - 1) Radius-to Diameter Ratio: 1.5.
    - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
    - c. Segmented, adjustable type elbows are not allowed.
- G. Branch Configuration:
  - 1. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct only.
    - a. Velocity 1000 fpm or lower: 90-degree tap, conical tap, 45-degree tap, or 45-degree lateral.

## PART 3 - EXECUTION

### 3.01 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
  - 1. Supply Ducts: 1-inch wg.
  - 2. Return Ducts (Negative Pressure): 1-inch wg.
  - 3. Exhaust Ducts (Negative Pressure): 1-inch wg.
- B. All ducts shall be standard galvanized steel.

### 3.02 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round ducts in lengths not less than 10 feet unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- F. Secure ductwork joints and fittings for materials-handling applications such as clothes dryers and sawdust collection systems with fastening devices that do not extend into the duct and airstream.
- G. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- K. Coordinate layout with suspended ceiling, lighting layouts, and similar finished work.
- L. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- M. Cap or seal temporary duct openings during construction. Remove caps or seals for final connections.
- N. Electrical Equipment Spaces: Route ducts to avoid passing through and above transformer vaults and electrical equipment spaces and enclosures.
- O. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- P. Protect duct interiors from the elements and foreign materials until building is enclosed.

- Q. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles where bare sheetmetal is visible from a normal viewer position. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer.

### 3.03 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
  - 1. For pressure classes lower than 2-inch wg, seal transverse joints.
- B. Seal ducts before external insulation is applied.

### 3.04 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- B. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- C. Install concrete inserts before placing concrete.

### 3.05 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories." Locate flexible connectors in sections of ductwork below roof level for roof mounted equipment unless indicated otherwise.
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.06 CLEANING OF EXISTING DUCTWORK SYSTEMS

- A. All existing ductwork indicated to remain within the remodeled area shall be cleaned by or under the direct supervision of a NADCA certified Air Systems Cleaning Specialist (ASCS).
- B. Use service openings, as required, for physical and mechanical entry and for inspection.
  - 1. Use existing openings where possible.
  - 2. Create other service openings to comply with duct standards.
- C. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.
- D. Particulate Collection and Odor Control:
  - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or larger) particles.

2. When venting vacuuming system to the outside, use filtration to contain debris removed from HVAC system, and locate exhaust down wind and away from air intakes and other points of entry into building.
- E. Clean the following metal duct systems by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
  2. Return-air ducts, turning vanes, and dampers.
  3. Supply-air ducts, turning vanes, and dampers.
- F. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
  3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
  4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
  5. Provide operative drainage system for washdown procedures.
  6. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present. Apply biocidal agents according to manufacturer's written instructions after removal of surface deposits and debris.
- G. Cleanliness Verification:
1. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.
  2. Visually inspect metal ducts for contaminants.
  3. Where contaminants are discovered, re-clean and reinspect ducts.

END OF SECTION 23 31 13

## SECTION 23 33 00 – AIR DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Volume dampers.
  - 2. Turning vanes.
  - 3. Flexible connectors.
  - 4. Flexible ducts.
  - 5. Spin-in and self-sealing take-off fittings.
- B. Related Sections include the following:
  - 1. Division 23 Section "Instrumentation and Control for HVAC" for control dampers and damper actuators.

#### 1.03 SUBMITTALS

- A. Product Data: For the following:
  - 1. Volume dampers.
  - 2. Flexible connectors.
  - 3. Flexible ducts.
  - 4. Spin-in fittings.

#### 1.04 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA Standard 500 for maximum leakage rates.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed.

## 2.02 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

## 2.03 VOLUME DAMPERS

- A. Manufacturers:
  - 1. Air Balance, Inc.
  - 2. American Warming and Ventilating.
  - 3. Greenheck.
  - 4. Johnson Controls, Inc.
  - 5. Nailor Industries Inc.
  - 6. Penn Ventilation Company, Inc.
  - 7. Pottorff
  - 8. Ruskin Company.
  - 9. Vent Products Company, Inc.
- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
- C. Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design, standard leakage rating, and suitable for horizontal or vertical applications.
  - 1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 16 gage, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
  - 2. Roll-Formed Steel Blades: 16 gage, galvanized sheet steel; maximum 6-inch width.
  - 3. Aluminum Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  - 4. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet; maximum 6-inch width..
  - 5. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum; maximum 6-inch width.
  - 6. Blade Axles: Nonferrous.
  - 7. Bearings: Molded synthetic.
  - 8. Tie Bars and Brackets: Aluminum.

- D. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting. Provide concealed type regulators, utilizing miter gears and universal joints as required, for dampers located above hard ceilings or in non-accessible locations.

#### 2.04 TURNING VANES

- A. Manufactured Turning Vanes: Single-wall vanes of galvanized sheet steel set into vane runners with friction insert tabs on 4 inch centers.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Duro Dyne Corp.

#### 2.05 FLEXIBLE DUCTS

- A. Manufacturers:
  - 1. Ductmate Industries, Inc.
  - 2. Flexmaster U.S.A., Inc.
  - 3. Hart & Cooley, Inc.
  - 4. McGill AirFlow Corporation.
  - 5. Thermaflex
- B. Insulated-Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; 1 inch fibrous-glass insulation; polyethylene vapor barrier film.
  - 1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 20 to plus 175 deg F.
- C. Insulated-Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; 1 inch fibrous-glass insulation; polyethylene vapor barrier film.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 5000 fpm.
  - 3. Temperature Range: Minus 10 to plus 175 deg F.
- D. Flexible Duct Clamps: Nylon strap, in sizes 3 through 18 inches to suit duct size.
- E. Flexible Elbow: UL listed for return air plenums, molded composite material, one-piece design to install over outside of flexible duct.



## 2.06 SPIN-IN AND SELF-SEALING TAKE-OFF FITTINGS

- A. Spin-in Fitting: Factory-fabricated assembly for making round take-off connections to rectangular ducts.
  - 1. Galvanized sheet steel construction.
  - 2. Spins into round duct opening.
  - 3. Adjustable damper with locking quadrant.
  - 4. Insulation guard for use with internally lined duct.
- B. Self-Sealing Fitting: Factory-fabricated assembly for making round take-off connections to rectangular ducts.
  - 1. Galvanized sheet steel construction.
  - 2. Neoprene seal on fitting flange for external attachment to round duct opening.
  - 3. Adjustable damper with locking quadrant.

## PART 3 - EXECUTION

### 3.01 APPLICATION AND INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.
- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
- D. Install automatic control dampers where indicated. Coordinate damper installation requirements with Division 23 Section "Instrumentation and Control for HVAC".
- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.
- F. Connect terminal units to supply ducts with maximum 24-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- G. Connect flexible ducts to metal ducts with positive-locking, nylon draw straps.

### 3.02 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION 23 33 00

## SECTION 23 37 13 – DIFFUSERS, REGISTERS, AND GRILLES

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.

#### 1.02 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, grilles, and continuous tubular fabric diffusers.
- B. Related Sections include the following:
  - 1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### 1.03 SUBMITTALS

- A. Product Data: For each product scheduled, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, model number, size, and accessories furnished.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carnes
  - 2. Kees
  - 3. Krueger
  - 4. Metal Industries, Inc.
  - 5. Nailor Industries
  - 6. Price Industries
  - 7. Seiho
  - 8. Titus
  - 9. Tuttle & Bailey

#### 2.02 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

#### 3.03 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

## SECTION 23 81 27 – COMPUTER ROOM SPLIT AIR-CONDITIONING SYSTEM

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The Work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the work of this Section.
- B. Reference Vibration Controls for HVAC Equipment, specification section 23 05 48, for equipment mounting.

#### 1.02 SUMMARY

- A. Section includes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components.

#### 1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Warranty: Sample of special warranty.
- C. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

#### 1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

#### 1.05 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

## 1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. For Compressor: Five years from date of Substantial Completion.
    - b. For Parts: One year from date of Substantial Completion.
    - c. For Labor: One year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Stulz Air Technology System, Inc.
  - 2. Liebert
  - 3. Approved equal.

### 2.02 INDOOR UNITS

- A. Ducted Ceiling-Mounted Evaporator-Fan Components:
  - 1. Cabinet: Manufacturer's standard with fully insulated casing constructed of galvanized steel or aluminum. Removable access panels shall provide access to fan, motor, evaporator coil and control box.
  - 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
  - 3. Fan: Direct drive, centrifugal double wide, double inlet. Motor shall be three speed, factory set, with internal overload protection.
  - 4. Condensate Drain Pan and Condensate Pump: Drain pan shall be stainless steel with factory-installed condensate pump and drain connection for hose attachment.
  - 5. Filters: Slide out, 1" deep, MERV 7.

### 2.03 OUTDOOR UNITS

- A. Air-Cooled, Compressor-Condenser Components:
  - 1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
  - 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    - a. Compressor Type: Scroll.
    - b. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.
  - 3. Fan: Aluminum-propeller type, directly connected to motor.
  - 4. Motor: Permanently lubricated, with integral thermal-overload protection.

5. Low Ambient Kit: Permits operation down to -20 deg F.

## 2.04 ACCESSORIES

- A. User Controller: Wired, air handler mounted controller to control compressor, evaporator fan, and outside air damper with the following features:
  1. Multi-level password security access to program.
  2. Cold start time delay.
  3. Short cycle protection.
  4. Remote start-stop capability.
  5. Automatic or manual restart selection upon loss of power.
  6. 24-hour time control of system stop and start with override button.
  7. Wall mounted, liquid-crystal display/interface indicating temperature, set-point temperature, time setting, and operating mode.
  8. Visual and audible alarm indication and alarm history.
- B. Condensate Pump: Field-installed, automatic operation with level sensor on drain pan to stop cooling operation if the level in drain pan is unacceptable.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Evaporator-fan unit to be mounted 12" above new lay-in ceiling.
- B. Provide isolation hangers and base pads for equipment in accordance with the requirements of section 23 05 48, Vibration Controls for HVAC Equipment.
- C. Install units level and plumb.
- D. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- E. Install roof-mounted, compressor-condenser components on equipment supports. Anchor units to supports with removable, cadmium-plated fasteners.
- F. Connect discharge tubing to indoor unit condensate drain pump and terminate to floor drain or other receptor.
- G. Install compressor-condenser components on vibration isolation pads.
- H. Install and connect refrigerant piping to component's quick-connect fittings. Install piping to allow access to unit.

### 3.02 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

### 3.03 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

### 3.04 DEMONSTRATION

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

END OF SECTION 23 81 27

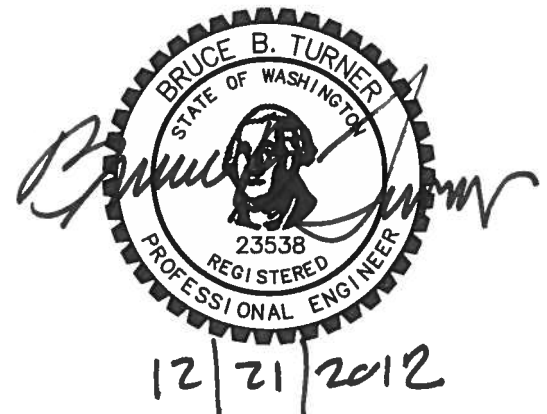
SECTION 260000 – ELECTRICAL SIGNATURE PAGE

The Engineer Stamp on this page applies to all portions of the Specifications referenced below.

ELECTRICAL ENGINEERING:

NAC|ENGINEERING  
1203 West Riverside Avenue  
Spokane, WA 99201  
(509) 624-8125 FAX (509) 838-8261

SPECIFICATION DIVISIONS 26, 27 & 28





## SECTION 260100 – ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, apply to the work specified in this section.
- B. Related Sections:
  - 1. Section 016310 – Products and Substitutions: Product substitution procedures
  - 2. Section 013000 – Shop Drawings, Product Data and Samples: Product data and shop drawing submittal procedures
  - 3. Section 010450 – Cutting & Patching: Requirements for cutting and patching
  - 4. Section 017700 – Project Closeout: Requirements for record documents and for operating and maintenance manuals
  - 5. Section 260400 – Electrical Demolition: Treatment of existing equipment

#### 1.2 SUMMARY

- A. Division 26 of the Specifications shall include all materials, equipment, labor, facilities, transportation and services for, and incidental to, the electrical work as indicated on the Drawings and/or specified herein.
- B. With respect to the work specified in Division 26, the administrative and procedural requirements contained in the general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, shall be expanded to include the requirements specified herein.

#### 1.3 WORKMANSHIP

- A. The work shown and/or specified shall be completely installed and connected in a first class and workmanlike manner and shall be complete in all details.
- B. All work shall be performed by properly qualified technicians.
- C. Workmanship shall comply with the National Electrical Installation Standards (NEIS), published by the National Electrical Contractors Association (NECA).
- D. Work shall be done in accordance with manufacturer's instructions and recommendations, except where the Drawings or these Specifications specifically indicate other instructions.

#### 1.4 DEFINITIONS

- A. As used on the electrical Drawings and in Division 26 of the Specifications, the following definitions shall apply.
- B. Definitions regarding scope of work:

1. "Furnish" shall mean "to supply and deliver equipment to the Project site."
  2. "Install" shall mean "to place in the designated location, anchor in place, make physical and electrical connections, perform specified testing and demonstration, and leave in operating condition."
  3. "Provide" shall mean "furnish" and "install," as defined above.
  4. "Verify" shall mean "accurately assess the conditions affecting the work and adjust the work to accommodate the conditions."
- C. Definitions regarding document presentation:
1. "Indicated" shall mean "called out by means of graphical representation, notes, schedules or text on the Drawings or in the Specifications."
  2. "Noted" shall mean "indicated," as defined above.
  3. "Shown" shall mean "indicated," as defined above.
  4. "Specified" shall mean "indicated," as defined above.
- D. Definitions regarding visibility of work:
1. "Concealed" shall mean "hidden from sight as in trenches below grade, in chases, in walls, in furred spaces or above ceilings."
  2. "Exposed" shall mean "not concealed," as defined above.
- E. Definitions regarding location:
1. "Interior" shall mean "bounded on all sides by a building envelope, including roofs, floors, walls, doors, windows and/or louvers in such a manner as to form a protected space, impervious to rain."
  2. "Exterior" shall mean "not interior," as defined above.
- F. Definitions regarding responsible entities:
1. "Contractor" shall mean "the entity that has entered into the Contract with the Owner to perform the Work on the Project in accordance with the Contract Documents."
  2. "Electrical Installer" shall mean "the firm, licensed by the applicable jurisdiction to perform electrical installation that is immediately responsible for installation and supervision of electrical work on the Project in accordance with the Contract Documents."
  3. "Owner's Representative" shall mean "the person or entity designated by the Owner to represent the Owner's interests with respect to the Project, and acting within the limits of the delegated authority."
  4. "System Installer" shall mean "the entity, qualified by special skill and experience and employing specially trained technicians, that is engaged by the Contractor to install a particular electrical, communications or electronic safety system on the Project in accordance with the Contract Documents."
  5. "System Vendor" shall mean "a factory branch office or authorized dealer/distributor for equipment provided as part of a particular electrical, communications or electronic safety system that maintains a local shop, equipped with spare parts and trained technicians skilled in installation, maintenance, trouble-shooting and repair of system components."

G. Other definitions:

1. "Vibrating Equipment" shall mean "electric motors, engine-generators, dry-type transformers, and equipment incorporating one or more such items."

1.5 INTERPRETATION OF DRAWINGS

- A. The Drawings are diagrammatic. The size and location of equipment are drawn to scale wherever possible, but some symbols are distorted dimensionally to attain clarity in representation. Locations shall be verified to avoid interference, preserve head room, maintain access for maintenance, and keep openings and passageways clear. Changes in location required to accomplish these purposes shall be made without additional compensation.
- B. The electrical Drawings shall serve as the working Drawings for the electrical work. But existing conditions shall take precedence over the electrical Drawings in matters of dimensional discrepancy. The Electrical Installer shall review the Drawings for the work of other trades and shall adjust the electrical work to conform to conditions indicated thereon. Report discrepancies to the Architect before proceeding with the Work.
- C. It is intended that outlets be located symmetrically with respect to Architectural elements. Coordinate outlet locations with equipment furnished by the Owner and equipment provided by other trades.
- D. With respect to circuitry, the Documents indicate the required type of wire or cable, the size and quantity of conductors, and points of termination, but do not necessarily show the intended routing or total number of raceways or cables required for the circuits. Provide additional raceways and cables wherever needed to complete the installation of the wiring as required for the specific equipment provided on the Project.
- E. Diagrams are schematic only and do not necessarily show the physical arrangement of the equipment. They shall not be used to obtain quantities or lineal runs of conduit.
- F. Working measurements shall be taken from the building, and checked with those shown on the Drawings. If they are found to vary from the latter, report the discrepancy to the Architect for adjustment before proceeding with the work. Failure to comply with the above instructions shall be cause for requiring the work to be altered as directed by the Architect with no additional compensation.
- G. The Drawings and Specifications are complimentary and what is required by one shall be as binding as if required by both. In the case of inconsistency between the Drawings and Specifications or within either document, provide the better quality or greater quantity of work, in accordance with the Architect's interpretation, without additional compensation.

1.6 CODES, PERMITS, AND FEES

- A. All work shall comply with the current requirements of the National Electrical Code (NEC), the International Building Code (IBC) and all applicable local, state and national codes and ordinances. It shall be the responsibility of the Electrical Installer to fully inform himself of all such requirements.

- B. If any conflict occurs between applicable codes and ordinances as versus the Drawings and Specifications, the codes and ordinances shall govern. Comply with any requirements of the Drawings and Specifications that are in excess of the codes and ordinances.
- C. Obtain and pay for all permits required to install the work specified in Division 26, 27 and 28. At the completion of the Project, deliver said permits, with the final approval of the Authority Having Jurisdiction, to the Owner.

#### 1.7 SUBSTITUTIONS AND PRODUCT OPTIONS

- A. In order to establish a basis of quality, certain equipment and materials are specified by designating one or more manufacturers' names, brands or catalog numbers. It is not the intent of these Specifications to exclude other equipment and materials that are equivalent to those specified. Written acceptance of substitutions must be obtained from the Architect prior to the bid date. Substitution requests shall be submitted to the Engineer within the time period and in the manner specified in the General and Supplementary Conditions and Division 1 of the Specifications.
- B. Substitution requests shall be accompanied by a substitution request form indicating deviations from the Contract Documents, if any. Acceptance of product substitutions shall not constitute authorization of deviations from the Contract Documents, unless the specific deviations are explicitly brought to the attention of the Architect or the Architect's Consultant on such a substitution request form.
- C. All material substitutions are subject to final review for compliance with the Specifications and shall meet or exceed the standard of those specified.
- D. Check dimensions of proposed substitute equipment and insure that substitute equipment can be installed in the space allowed and that the equipment operates as intended.
- E. Reimburse the cost of any redesign caused by a product substitution, whether accepted or not.

#### 1.8 SHOP DRAWINGS AND PRODUCT DATA

- A. Submit sufficient information to prove compliance with the Contract Documents and, for substitute equipment and materials, to prove equivalence to the specified products.
- B. Before ordering materials or equipment, submit shop drawings and/or product data, as indicated in the Specifications, for proposed material and equipment.
- C. Shop drawings and product data shall be reviewed, approved and stamped by the Contractor and the Electrical Installer prior to submitting documents for the Architect's Consultant review. Shop drawings and product data without such note of approval shall be subject to return without review.
- D. Submittals for each Specification section shall be accompanied by a transmittal.
- E. On an attached separate cover sheet, prepared on the Contractor's or Electrical Installer's letterhead, record relevant information, requests for data, revisions (other than those

requested by the Architect or the Architect's Consultant on previous submittals), and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.

- F. Absence of such a cover sheet shall constitute representation that the submitted items, having been reviewed and approved by the Contractor and the Electrical Installer, fully comply with all requirements of the Contract Documents.
- G. Product Data: Catalog sheets shall be submitted for standard catalog items. Product data shall show the manufacturer, catalog number, listing information and complete descriptive information, including ratings, finish, dimensions and kind of materials used. Where materials or equipment are specified to conform to published industry standards, include evidence of compliance.
- H. Shop Drawings: Outline drawings and component information shall be submitted for assemblies, systems and other non-standard or non-cataloged items. Shop drawings shall show manufacturer, manufacturer's type designation and complete descriptive information, including ratings, finish, dimensions and kind of materials used. In addition, shop drawings shall include the following information, when specified elsewhere in the Specifications:
  - 1. Arrangement of components
  - 2. Raceway entry locations
  - 3. Access requirements
  - 4. Calculations
  - 5. Adjustment settings
  - 6. Floor plans
  - 7. Details
  - 8. Riser diagrams
  - 9. Wiring diagrams
  - 10. Operational matrices
  - 11. Reports
- I. Samples: Samples shall be submitted for direct examination of certain critical items when requested by the Architect/Architect's Consultant.
- J. All submittal data shall be keyed to match the Specification section or Drawing number together with note or detail reference indicated in the Documents. If a shop drawing or product data sheet contains multiple products, the specific products intended for the Project shall be clearly identified in a manner readily visible when copied by black-and-white reproduction process. Submittal data without such identification shall be subject to return without review.
- K. Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- L. All sheets larger than 216 mm by 280 mm (8½ in by 11 in) shall be neatly folded to 216 mm by 280 mm (8½ in by 11 in) in size.

- M. All submittal data shall clearly identify the equipment as Underwriter's Laboratory approved and listed. Submittals which do not include this information will be considered incomplete, and will be returned "REJECTED".
- N. Submittal data shall be arranged by Specification section, with items identified on the Drawings but not assignable to any specification section grouped at the end. At the beginning of each section of submittals, all items submitted under that section shall be listed by catalog number, model number, or part number with two blank lines between each item to allow space for review notations. To allow space for the review stamp and other notations by the Architect's Consultant, the right half of the sheets on which the products are listed shall be left blank, except for the Contractor's and Electrical Installer's stamps of approval.
- O. Information submitted in improper format shall be subject to return without review.
- P. In order to facilitate timely review, electrical shop drawings and product data shall be submitted within 30 days of the notice to proceed with the Work.
- Q. The submittal review by the Architect or the Architect's Consultant shall not relieve the Contractor's responsibility to furnish materials and perform work as required by the Contract Documents. If the submittal includes any deviations from the Contract Documents, such deviations shall be presumed as not having been reviewed, except where specific emphatic attention is called to the deviation.
- R. Submit one (1) original of submittal information. After reviewing and marking the original, the Architect and/or the Architect's Consultant will reproduce copies for themselves and for the Owner and/or Project Manager and then return the original. Reproduce additional copies as required for the Contractor's use, including copies for inclusion in the Operating and Maintenance Manuals, and one (1) copy as a Project Record Document.
- S. Maintain at the Project site, in neatly indexed form, a notebook containing the reviewed submittal data. Data shall be available for use by the Architect and the Architect's Consultant throughout the duration of the Project.

## 1.9 COORDINATION AND COOPERATION

- A. Coordinate the electrical work with all other trades performing work on the Project. Refer to the entire set of Contract Drawings, all sections of the Specifications, and any Addendums, including those items that apply to other trades, for additional details necessary to properly coordinate the work.
- B. An electrical workman shall be present at the placing of any concrete or masonry that contains electrical work to insure that the electrical work is not damaged or disturbed.
- C. Relocation, cutting, patching, finishing and other work made necessary to repair defective materials, to remedy defective workmanship or because of failure to properly anticipate the requirements of the electrical work and coordinate with the work of other trades, shall be performed with no additional compensation. Cutting and patching shall conform to the requirements in Section 017329.

- D. Cooperate at all times with the work of other trades on the Project to avoid disputes and delays to the progress of the Project. All points in dispute shall be referred to the Architect.

#### 1.10 WORK SCHEDULE

- A. Accommodate the Project schedule and the requirements of the Owner. Perform overtime work necessary to meet the Project schedule and the Owner's requirements.
- B. Electrical system shutdowns shall be scheduled with and approved by the Owner prior to proceeding with any shutdown.
- C. To accommodate the Owner's operational requirements, it may be necessary to schedule work for other than normal working hours.

#### 1.11 REVIEW OF THE WORK

- A. Work shall be subject to review by the Architect and the Architect's Consultant at any and all times.
- B. Work shall be subject to inspection by code enforcing authorities at any and all times.
- C. Give the Architect, the Architect's Consultant and code enforcing authorities all assistance necessary to review the work.

#### 1.12 SUBMITTALS

- A. Schedule of Values: Itemization of the value of the Division 26, 27 and 28 work.
- B. Training Sign-In: Attendee sign-in sheet for the training session.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Materials and equipment shall be new and in an unused condition when delivered to the site.
- B. Materials and equipment shall bear the Underwriter's Laboratory (UL) label or the label of another product testing laboratory approved by the AHJ. The label shall indicate that the items are suitable for the intended use and for the conditions in which they are installed, including location and ambient temperature.

### PART 3 - EXECUTION

#### 3.1 VISITING THE SITE

- A. To ascertain conditions affecting the work, the Contractor and the Electrical Installer shall examine the site of the work prior to submitting a bid. No allowances will be made due to lack of knowledge of such conditions. Regarding conditions affecting the work, no

statement by the Architect, the Architect's Consultant, the Owner or their representatives will be binding.

### 3.2 PROTECTION AND CLEANING

- A. During the progress of the work, provide adequate means to fully protect materials and equipment against damage due to weather, construction activities and other causes. While in storage and during the progress of the work, material shall be covered to insure that finished surfaces will not be damaged, marred or splattered with other materials. Electrical conductors, buses and connections, electronic components and moving parts shall be kept clean and dry.
- B. Protect nameplates on electrical equipment from being obscured by paint.
- C. Protect latches on equipment cabinets, luminaires, devices, device faceplates and other exposed electrical items against accidental painting.
- D. Clean the site daily. Remove all scrap material, packing cartons and other debris created as a result of the electrical work.
- E. All luminaires, devices and equipment within the Project area, both new and existing, shall be thoroughly cleaned and left in proper condition for use. All debris and unused materials shall be removed from the construction site, leaving the premises in a clean condition.

### 3.3 MANAGEMENT OF CONSTRUCTION WASTE

- A. Separate recyclable materials from electrical construction waste. Segregate recyclable materials by type. Legally dispose of construction waste off site.

### 3.4 ADJUSTMENT, TESTING AND DEMONSTRATION

- A. All work shall be complete in every respect, tested and proved satisfactory to the Architect and the local, state and federal inspectors governing the installation.
- B. Refer to Section 260400 for preliminary inspection and testing of existing equipment.
- C. Notify the Architect's Consultant, the Owner's Representative at least two (2) weeks in advance of the date of each test, to allow witnessing of the tests.
- D. Supply tools, instruments, gauges, testing equipment, protective devices and safety equipment for adjustment, testing and demonstration.
- E. During adjustment and testing, carefully record all settings and all test results, including expected test results, actual test results, and corrective actions taken. Records shall be submitted to the Architect's Consultant and included in the Operating and Maintenance Manuals.
- F. Perform tests as necessary to insure against concealment of defective materials and/or workmanship.



- G. Determine, by proper testing, that all wiring is free from short circuits between conductors and short circuits between conductors and ground and that all circuits have proper continuity. All defects shall be corrected and re-tested before electrical equipment or luminaires are connected to any circuit.
- H. Set adjustable control devices in accordance with the manufacturer's recommendations and as directed by the Architect's Consultant.
- I. Systems shall be adjusted and tested for proper operation and conformity to Specifications. Perform adjustment and testing as described in other Sections of Division 26 of the Specifications.
- J. Correct any deficiencies discovered as a result of the above testing, and completely retest the work affected by such corrections, with no additional compensation.
- K. After the work has been completed, tested and is operating properly, demonstrate, by actual usage, the proper operation of each control device and system function, in the presence of the Owner's Representative.

### 3.5 ON-SITE TRAINING

- A. Place all electrical systems, including lighting, power, signal, communications and miscellaneous systems in initial operation.
- B. Retain representatives of the equipment manufacturers for certain electrical systems to conduct specific training in the maintenance and operation of each system as specified in the corresponding Sections of the Specifications.
- C. On-site training shall follow written training plans, prepared in advance. The training plans shall outline the topics to be covered, the publications to be used, and the training schedule.
- D. In addition to specific training for certain systems that is conducted by representatives of the equipment manufacturers, the Electrical Installer shall conduct two (2) hours minimum of further training for the Owner's maintenance personnel in operating and maintenance of other electrical system components that require periodic maintenance. Training time shall be extended as necessary to satisfy the Owner's Representative that all pertinent topics have been adequately covered.
- E. The training shall be conducted after the Operating and Maintenance Manuals for the project are completed and available for use during the training session.
- F. Maintain training sign-in sheets, upon which participants in each training session, including the instructors, shall record their names. The training sign-in sheets shall be dated.
- G. The training shall be conducted by personnel who are thoroughly familiar with the equipment, and with the Project. The training shall include instruction and field demonstration. As a minimum, the training shall cover, but not be limited to, the following topics:

1. General overview of the electrical systems, including expansion capability.
2. Location, adjustment procedures and settings for adjustable devices.
3. Location and operation of control devices.
4. Location of batteries, moving parts and other items that require periodic maintenance.
5. Recommended maintenance procedures and intervals.

### 3.6 RECORD DOCUMENTS

- A. At the beginning of the work, set aside one complete set of the Drawings and Specifications which shall be maintained throughout the course of the Project as a Record Document set. Notations shall be entered on the set in a neat and legible manner as specified in the general provisions of the Contract, including General and Supplementary Conditions and Division 1 of the Specifications.
- B. The Record Documents shall be updated daily by the Electrical Installer foreman to record every change from the original Documents. This Record Document set shall not be used for any other purpose and shall be available at the Project site for review at any time.
- C. As a minimum, pertinent information shall be entered on the Record Document set as follows:
  1. Actual routing of feeders and major systems raceways.
  2. Actual nameplate full-load amps for each item of equipment on the equipment schedule.
  3. Actual fuse and overload device selection.
  4. Actual location and physical size of electrical equipment.
  5. Actual location of electrical control devices and outlets installed at locations differing from the locations indicated on the original Documents.
  6. Actual electrical circuitry, where differing from the circuitry indicated on the original Documents. Where deviations are indicated, identify both what was added and what was deleted.
  7. Actual types, ratings, sizes, quantities and other pertinent data related to the electrical work, where such data differs from that indicated on the original Documents.
  8. Actual manufacturers and/or model numbers as necessary to record selections or substitutions made.
  9. Revisions to details shown on the Drawings.
  10. Changes made by Addendum, Document Clarification, Change Order, Construction Change Directive, or at the direction of the Architect.
- D. Submit the Record Document set to the Architect's Consultant for review before requesting final punchlist review.
- E. Deliver the completed Record Documents to the Owner in the manner prescribed in the general provisions of the Contract, including General and Supplemental Conditions.

### 3.7 OPERATING & MAINTENANCE MANUALS

- A. Prepare three (3) Operating and Maintenance Manuals describing the electrical systems and equipment specified in Division 26 of the Specifications. In addition, provide one complete set in electronic format (Adobe Acrobat PDF format is acceptable), stored on a compact disc (CD).
- B. Data included in the Manuals shall include, but not be limited to, the following:
  - 1. Copies of data submitted under “Shop Drawings and Product Data”
  - 2. Test reports
  - 3. Operation instructions
  - 4. Maintenance instructions
  - 5. Certificates
  - 6. Warranties, where the manufacturer’s warranty exceeds one year
- C. Complete information shall be included in the Manuals, regardless of whether information was omitted from earlier submittals. Data in Manuals shall be 216 mm by 280 mm (8½ in by 11 in) size and shall be neat, clean copies. Facsimile copies or other poor quality prints are unacceptable.
- D. Manuals shall be of the loose-leaf type, in heavy-duty three-ring binders with plastic tab sheets indicating system or equipment described. Individual binders shall not exceed 76 mm (3 in) in width; sub-divide the Manuals into separate volumes as necessary to limit binder width. Material in each binder shall not exceed 75% of the binder width. Each volume of the Manuals shall be adequately labeled for identification on the front cover and on the binder edge. Binders shall be imprinted in contrasting letters with the Project title, the date, the subject matter or contents, and the names of the Architect, the Contractor and the Electrical Installer. For additional requirements, refer to the general provisions of the Contract, including General and Supplementary Conditions and Division 1 of the Specifications.
- E. Preliminary copies of the Manuals shall be submitted to the Architect’s Consultant for review at least two (2) months prior to scheduling on-site training for the Owner’s personnel, to allow time for the Manuals to be reviewed, finalized, accepted and made available for the Owner’s use during the training sessions. Final copies of the Manuals shall be submitted for review at least three (3) weeks prior to scheduling on-site training.
- F. Completed Manuals shall be delivered to the Owner prior to the first on-site training session.

### 3.8 PROJECT CLOSEOUT

- A. Notify the Architect in writing when the electrical work is complete and ready for review by the Architect’s Consultant. A representative of the Electrical Installer shall accompany the Architect’s Consultant during the review and shall remove cover plates, switchboard and panelboard covers, cabinet covers and other access panels as directed by the Architect’s Consultant.

- B. The Architect's Consultant will prepare a "punchlist" of incorrect or incomplete items of the work. Notify the Architect in writing when the "punchlist" items have been completed and are ready for review by the Architects' Consultant. Submit, together with the written notice, an annotated copy of the punchlist denoting the items completed or, if not completed, the reason for the discrepancy and the expected disposition of the item in question.
- C. Any additional trips to the Project site that become necessary due to failure to complete items on the original "punchlist" before requesting punchlist review will be charged to the Contractor at normal published rate of the Architect's Consultant plus travel expenses.

### 3.9 GUARANTEE

- A. Guarantee the satisfactory operation of all material and equipment installed under Division 26 of the Specifications and shall repair or replace, to the satisfaction of the Owner and Architect, any material, equipment or workmanship which is found to be defective within one (1) year of the date of substantial completion.
- B. Exception: New engine-generators shall be guaranteed for a period of five (5) years.

### 3.10 SCHEDULE OF VALUES

- A. Within thirty (30) days following the notice to proceed with the Work, submit to the Architects's Consultant an itemization of the value of the Division 26 work.
- B. Values shall be itemized as follows:
  - 1. Mobilization and Miscellaneous Overhead Expenses
  - 2. Permits
  - 3. Punchlist and Project Close-out, 1.5% minimum
  - 4. Demolition
  - 5. Miscellaneous Building Materials
  - 6. Miscellaneous Building Labor
  - 7. Feeder Materials
  - 8. Feeder Labor
  - 9. Branch Circuit Materials
  - 10. Branch Circuit Labor
  - 11. Distribution and Branch-circuit Panelboards
  - 12. Panelboard Installation Labor
  - 13. Dry-type Transformer
  - 14. Transformer Labor
  - 15. Lighting Equipment
  - 16. Lighting Labor
  - 17. Wiring Devices
  - 18. Wiring Device Labor
  - 19. Multi-outlet Assemblies
  - 20. Multi-outlet Labor
  - 21. Equipment Connections
  - 22. Access Control Materials

- 23. Access Control Equipment
- 24. Fire Alarm Materials
- 25. Fire Alarm Labor

END OF SECTION 260100

## SECTION 260400 – ELECTRICAL DEMOLITION

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related sections:
  - 1. Section 010450 – Cutting and Patching: Requirements for cutting and patching
  - 2. Section 0207009 – Selective Demolition: Disconnection of incidental electrical items
  - 3. Section 260510 – Electrical Common Work: Cutting, drilling and patching.

#### 1.2 SUMMARY

- A. Perform selective demolition of existing electrical materials, including disconnecting circuits and dismounting, removing and properly disposing of electrical items in accordance with the requirements indicated on the Drawings and specified herein.
- B. Maintain continuity of electrical services. Where interruption of service is necessary, measures shall be taken to minimize the interruption, and the work shall be scheduled with the Owner's Representative such that the interruptions do not limit the Owner's use of existing occupied facilities.
- C. All existing 120-VAC receptacles and all telecommunications outlets indicated on the Drawings as existing-to-remain shall be maintained in place along with all associated boxes, raceway conductors and cabling.
- D. The Owner retains first right of refusal for all existing materials and equipment. Equipment the Owner desires to retain shall be removed and delivered to a location designated by the Owner. All removed materials and equipment the Owner does not wish to retain shall be removed from the site and legally disposed.

#### 1.3 EXISTING CONDITIONS

- A. Existing equipment raceways and wiring indicated on the Drawings are shown only as a guide. Actual field conditions may vary from that shown on the Drawings. Report discrepancies to the Engineer before disturbing existing conditions.
- B. Upon encountering existing electrical materials or installed conditions that are hazardous, not code-compliant, improperly supported or otherwise not in accord with generally accepted practice, notify the Engineer and the Owner's Representative
- C. Specific attention is directed to the possibility of the existence of asbestos-containing materials at the Project site. Work shall proceed only after the Owner's Representative signifies that asbestos abatement is complete in the work area.

#### 1.4 SUBMITTALS

- A. None required.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. Materials for Extending Electrical Work: As specified in applicable Sections of these Specifications.
- B. Materials for Repairing Electrical Work: As specified in applicable Sections of these Specifications, otherwise match existing materials.

#### PART 3 - EXECUTION

- A. The Work on this project is phased to suit the requirements of the Owner. During the course of construction, it may be necessary to make temporary installations or connections to accommodate the phased nature of the Work. Some work may need to be installed, removed and then reinstalled or connected, disconnected and then reconnected in order to satisfy the operational requirements of the Owner.

##### 3.2 CONTINUITY OF SERVICE

- A. Interruptions of existing electrical systems shall be kept to a minimum. Obtain permission from the Owner's Representative before interrupting the operation of any existing electrical system. Circuit reconnections for existing loads shall be made in the smallest increments possible. Branch circuits shall be reconnected one by one wherever possible.
- B. Where existing active electrical equipment and/or circuits are encountered during demolition, they shall be relocated and/or extended as required to accommodate the remodeling activity. Extend existing circuits using materials and methods compatible with the existing installations, in accordance with the applicable Sections of these specifications.
- C. Protect, brace and support existing active electrical equipment and/or circuits as required for proper execution of the electrical work and the work of other trades.
- D. Existing circuits which are damaged by work under this Contract shall be repaired. Damaged raceways and conductors shall be repaired with new material of the same type as existing. Power and lighting conductors shall extend without splices to the first outlet or junction box on both sides of the location of the circuit damage.
- E. Work shall be scheduled so that electrical system interruptions do not limit the Owner's use of existing, occupied facilities. Provide temporary equipment and wiring to maintain existing electrical systems in operation. The Owner may require electrical system interruptions to occur at night, on weekends or on holidays. Include such overtime work as necessary to meet the Owner's requirements.

### 3.3 SCHEDULING

- A. Prepare, in writing, proposed interruption schedules for all equipment, circuits and systems that must be disrupted during the course of construction. The schedules shall be submitted to the Owner's Representative for approval at least seven days prior to the first proposed interruption. As a minimum, the schedules shall include the following information:
  - 1. Specific circuits to be interrupted
  - 2. Loads or systems to be affected
  - 3. Date and time proposed for the interruption
  - 4. Date and time expected for restoration of normal service
  - 5. Measures proposed to minimize the interruption
  - 6. Back-up plan or alternative measures for critical loads, in case of emergency
- B. Schedules proposed by the Contractor are subject to adjustment by the Owner.

### 3.4 PRELIMINARY INSPECTION AND TESTING

- A. Where existing electrical systems are to be modified by removing devices, relocating devices or adding additional devices, preliminary tests shall be performed on the affected systems prior to performing modifications. The preliminary tests shall be similar to the testing specified in other Sections of Division 26 of the Specifications for such systems. Test for proper operation and conformity to requirements of the applicable Specifications sections. Where additional devices are to be added, verify whether the system is suitable for addition of devices as indicated. Perform tests and maintain test records as described in other Sections of Division 26 of the Specifications for said systems.
- B. Any deficiencies discovered as a result of the preliminary inspection and testing shall be brought to the attention of the Engineer and the Owner's Representative.
- C. In the absence of notification to the Engineer and the Owner's Representative that deficiencies were discovered prior to disturbing existing equipment and/or modifying existing systems, it shall be assumed that the existing equipment and systems were in satisfactory condition, were operational and were functioning properly prior to the work being performed. In such cases, any deficiencies discovered after disturbing equipment or modifying systems shall be corrected such that the equipment and systems are complete and operational at the conclusion of the Work.
- D. Notify the Owner's Representative at least one (1) week in advance of the dates when the preliminary inspection and testing will be performed, so that he may witness the inspection and testing.
- E. Supply instruments, gauges, testing equipment, protective devices and safety equipment for all testing.

### 3.5 DEMOLITION

- A. Demolition work shall be closely coordinated with the work of other trades and the requirements of other Divisions of these specifications.



- B. Cutting, drilling and patching in existing construction shall conform to the requirements of Sections 017329 and 260510.
- C. Disconnect abandoned circuits and circuits that serve equipment that is to be removed or relocated. Prior to disconnecting any circuit, verify that the wiring serves only facilities that are inactive and abandoned. Properly disconnect circuits at wiring terminals. Do not leave cut-off wiring tails.
- D. Remove raceway, conductors and miscellaneous materials associated with equipment being removed and as required by Project conditions. Equipment not specifically indicated to be removed shall remain in service. Where the intended disposition of an electrical item is not clear, verify the intended disposition of said item with the Owner, prior to disturbing it.
- E. Inactive and abandoned power wire and cable, including disconnected circuits and circuits from which all terminal devices have been eliminated, shall be removed back to the source of supply.
- F. Inactive and abandoned control wire and cable, including circuits for control of equipment that is disconnected or removed, and control circuits that are disconnected or no longer in use, shall be completely removed.
- G. Remove raceway as required to accommodate the work of other trades. Existing raceway that remains may be reused to the extent possible, provided that it is properly supported and compliant with the requirements of other Sections of these specifications.
- H. Abandoned raceway shall be removed where it is accessible, including exposed raceway, raceway above accessible ceilings, and raceway rendered accessible by demolition activities. Raceway below grade, under slabs or otherwise inaccessible may be abandoned in place, except as otherwise indicated.
- I. Maintain access to existing electrical devices, outlets and junction boxes that remain. Modify the installation or provide access panels as appropriate.
- J. Outlet boxes and other electrical openings that remain in existing walls shall have new plates or special covers installed. New device rings or extension rings shall be installed on existing outlet boxes located in walls that receive new finished surfaces, as required to match the thickness of the new wall surfaces.
- K. Existing equipment and materials intended to be reused shall be removed and reinstalled at a time convenient to the Owner. Protect, clean, renovate, adjust, and test equipment that is to be reused, as directed by the Engineer's Consultant. Permission for removal shall be obtained from the Owner's Representative before any removal work is started. Reused equipment shall be reinstalled in the new location in a manner as expedient as possible. Installation shall conform to the applicable Sections of these specifications.
- L. The Owner retains first right of refusal for all existing equipment and materials removed from the Project. All removed equipment and materials that the Owner wishes to retain shall be delivered to a storage site designated by the Owner. All removed equipment and

materials that the Owner does not wish to retain shall become property of the Contractor. Dispose of such equipment and materials off site in a legal manner.

- M. Disposal of waste from electrical demolition shall comply with local regulations.
- N. Equipment within the Project area shall be protected during the work and cleaned just prior to completion of the work.

END OF SECTION 260400

## SECTION 260510 – ELECTRICAL COMMON WORK

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work specified in this section.
- B. Related sections:
  - 1. Section 010450 – Cutting and Patching: Requirements for cutting and patching
  - 2. Section 260100 – Electrical Requirements: Product substitution procedures

#### 1.2 SUMMARY

- A. Provide miscellaneous general construction materials for application in direct conjunction with the electrical Work on the Project. Such materials shall include sleeves, roof flashing, waterproofing, grout, concrete, reinforcing, firestopping, sealants, access doors, plywood terminal boards and incidental field painting.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of roof flashing provided on the Project for electrical work.
- B. Installation Details: For each type of firestopping assembly provided on the Project to protect fire-rated through-penetrations for electrical work.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Patching Materials: Match the materials in the adjacent construction.
- B. Sleeves: Galvanized steel. Where sleeves are provided for electrical through-penetrations through fire-rated partitions, the sleeves shall be of a type suitable for use with the wiring method employed and shall be identified as such on the manufacturer's UL-approved installation detail for the firestopping material used. Sleeves through fire-rated partitions for communications cable and other low-voltage cables that are not installed in raceways shall include a built-in fire sealing system that automatically adjusts to the amount of cables installed, equivalent to "EZ-Path" fire-rated pathways, as manufactured by Specified Technologies Inc.

#### 2.2 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers shall be as listed above.
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 CUTTING, DRILLING AND PATCHING

- A. Perform cutting, drilling and patching required to perform the work specified in Division 26. Cutting, drilling and patching shall conform to the requirements of Section 010450 and the conditions specified herein.
- B. Construction of a structural nature shall not be disturbed without the approval of the Architect. In general, cutting or drilling through floors, walls and partitions shall be avoided. Only where absolutely necessary will such cutting or drilling be permitted.
- C. When cutting or drilling is necessary, perform the cutting or drilling in a careful manner with due consideration to maintaining the integrity of the building's structural elements. Remove material in small sections, using methods that will not crack or structurally disturb the adjacent construction. Avoid the use of power-driven impact tools. Cut concrete and masonry using a masonry saw, following junctures in the construction where possible. Holes through concrete or masonry shall be made with a core drill. Holes through wood shall be made with wood drills. Holes in wall studs and structural members shall not be made through edges of members.
- D. Penetrations in structural members and floor slabs shall be reinforced in accordance with the Structural Drawings and the applicable provisions of the Specifications.
- E. Disturbed construction and finishes shall be restored to the original condition. Skilled workers of the appropriate building trade shall use materials of matching kind and quality to restore disturbed construction and finishes.
- F. Obtain approval from the Architect for the proposed extent of cutting, drilling and patching. Where cutting or drilling involves major structural elements, obtain permission from Architect in advance for each individual opening.
- G. Openings in the structure shall comply with the requirements indicated on the Structural drawings. Provide reinforcing around openings as indicated on the Structural drawings.

### 3.2 SEALING

- A. Seal penetrations through, and openings in, wall, ceiling and floor assemblies that constitute the perimeter of return-air plenums. Openings accommodating such items as raceway, outlet boxes, and equipment backboxes, shall be sealed. Penetrations shall be sealed on both sides of the wall, ceiling or floor.

### 3.3 SEALING ROOF PENETRATIONS

- A. Electrical raceways penetrating roofs shall be sealed to prevent water infiltration.
- B. Penetrations through roofs shall conform to the requirements of the roofing manufacturer.

END OF SECTION 260510

## SECTION 260519 – LOW-VOLTAGE CONDUCTORS & CABLES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work specified in this section.
- B. Related sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260510 – Electrical Common Work: Firestopping
  - 3. Section 260533 – Raceways: Conditions for combining branch-circuit home-runs

#### 1.2 SUMMARY

- A. Provide a complete system of wires and cables for power systems operating below 600 VAC as indicated.
- B. Provide a complete system of wires and cables for communications and electronic security systems.
- C. Test conductors as specified herein.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of wire and cable provided on the Project for systems operating between 100 VAC and 600 VAC.
- B. Test Report: Measured insulation resistance values of conductors.

#### 1.4 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, updated to record any changes.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Insulated Copper Wire: Copper conductors shall be soft-drawn copper, 100% conductivity. Conductors installed fully or partially below grade, below concrete slabs on grade or in damp/wet locations shall have THWN-2 or XHHW-2 insulation rated for 600VAC. Conductors installed in dry locations entirely above grade shall have THHN, THWN-2 or XHHW-2 insulation rated for 600VAC. Wire sizes #10 AWG and smaller shall be solid; wire sizes #8 AWG and larger shall be stranded. Wire sizes #6 AWG and smaller shall have color-coded insulation. Minimum size of copper conductors for power and lighting circuits shall be #12 AWG. Wire shall be marked with wire gauge and insulation type on 610 mm (24 in) intervals.

- B. Mechanical Connectors: Metal thread-on core type, molded connectors shall be used for splicing #10 AWG and smaller wire sizes with solid copper conductors. Wire and cable with stranded conductors shall be spliced with lugs or bolted connectors and shall be wrapped with electrical tape to a thickness equal to the wire insulation.
- C. Wire Pulling Lubricant shall be non-toxic, polymer based and compatible with conductor insulation. Lubricant shall not reduce the dielectric strength of the conductor insulation.

## 2.2 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers shall be as follows:
  - 1. Insulated Copper Wire: Rome, Southwire, General Cable, American Insulated Wire, Superior/Essex or Cerrowire
  - 2. Cable Connectors: Cooper/Crouse-Hinds, Hubbell/Killark, Thomas & Betts or cable manufacturer
  - 3. Molded Connectors: 3M or Buchanan
  - 4. Lug and Bolted Connectors: Burndy, O.Z./Gedney or Thomas & Betts
  - 5. Wire Pulling Lubricant: Thomas & Betts or Ideal
  - 6. Tape: 3M
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Wire and cable shall be delivered to the project site in the original containers bearing the UL label.
- B. Conductors installed in raceway exposed outdoors shall have XHHW-2 insulation.
- C. Conductor insulation shall be color coded as follows:

CONDUCTOR	208Y/120 VAC	480Y/277 VAC
Phase A	Black	Match existing
Phase B	Red	Match existing
Phase C	Blue	Match existing
Neutral	White *	Grey *
Ground	Green	Green with yellow stripe

\*Neutral shall have colored stripe where so specified.

- D. Color-coding on conductors #6 AWG and smaller wire shall be achieved by installing wire with properly colored insulation. Conductors larger than #6 AWG, if not otherwise properly color-coded, shall be identified with colored insulating tape, helically-wound a minimum of 76 mm (3 in) along the conductor length at each terminal and at each accessible point along the conductor.

- E. Individual neutral conductors are required for each circuit shall have solid colored insulation with continuous colored stripes to match the phase with which the neutral is associated. Neutral striping may be omitted where no more than one circuit occupies the same raceway.
- F. Single-conductor wires shall be installed in appropriate raceway systems. All phase, neutral and ground conductors of a branch circuit shall be installed in a common raceway. Each feeder raceway shall contain phase, neutral and ground conductors. Phase, neutral and ground conductors serving the same circuit shall not be isolated in different raceways.
- G. All wire and cable in a single raceway shall be installed at the same time.
- H. Wire and cables shall be installed in such a manner as to avoid kinking of conductors and abrasion to the insulation. Only approved lubricants shall be used for installing wire and cables. Oil or grease shall not be used to lubricate wires.
- I. Insulated bushings shall be installed in all raceway couplings and connectors before wires are installed.
- J. Where more than three current-carrying conductors are installed in a single raceway, the minimum wire size shall be increased to comply with NEC 310.15(B)(2). For circuits with individual neutral conductors, both the phase conductor and the neutral conductor of each circuit shall be counted as current-carrying.
- K. Where the conductor length from the overcurrent device to the first outlet exceeds 30 m (100 ft), the minimum wire size shall be #10 AWG.
- L. Wiring shall be arranged as shown on the drawings. Multiple branch circuits shown as separate home-runs may be combined as permitted in Section 260533.
- M. Provide a separate neutral conductor for each branch circuit. Shared neutrals will not be allowed.
- N. Except where conductor sizes are indicated on the drawings, the following schedule shall be adhered to:

CIRCUIT OVERCURRENT DEVICE RATING	CONDUCTOR SIZE (COPPER)
20 amperes or less	#12 AWG
25 to 30 amperes	#10 AWG
35 to 40 amperes	#8 AWG
45 to 50 amperes	#6 AWG
60 to 70 amperes	#4 AWG
80 amperes	#3 AWG
90 amperes	#2 AWG
100 amperes	#1 AWG

- O. Lengths of parallel conductors shall be identical.

- P. Feeder conductors shall be installed continuous and without splices.
- Q. Installed conductors in lengths up to 300 m (1000 ft) shall have a minimum resistance of 100 mega-ohms between adjacent conductors and between each conductor and ground. The required minimum resistance value between conductors over 300 m (1000 ft) shall be reduced in proportion to the excess length. Conductors with resistance values below the minimum acceptable level shall be replaced.
- R. All splices shall be made in properly sized junction boxes or pull boxes.
- S. Neatly train and lace wiring inside boxes, cabinets, panelboards and equipment enclosures.
- T. Clean conductor surfaces before installing connectors.
- U. Tighten all lug and bolt type mechanical connections in accordance with manufacturer's instructions before taping.

### 3.2 TESTING

- A. Notify the Owner's Representative and the Engineer at least one (1) week in advance of the date of each test, to allow witnessing of the tests.
- B. Supply tools, instruments, gauges, testing equipment, protective devices and safety equipment for testing.
- C. During testing, carefully record all test results, including expected test results, actual test results, and corrective actions taken. Records shall be submitted to the Engineer and included in the Operating & Maintenance Manuals.
- D. Measure and record insulation resistance values for each service entrance conductor and each conductor rated 100 Amperes or more. The test report shall include the manufacturer's name and model number of the testing instrument, the date of the test, test voltage, conductor identification, conductor length, measured resistance, ambient temperature, temperature compensation factor and calculated resistance.
- E. Conductor insulation shall be tested using 500 VDC or 1,000 VDC test equipment as recommended by the wire manufacturer. Recorded measurements shall be adjusted for ambient temperature. Each test shall be maintained for a period of time sufficient for capacitance charging current and insulation absorption current to reach steady state.
- F. If a conductor is discovered, as a result of the above testing, to have an insulation resistance less than the value stipulated herein, all the conductors in the affected run shall be replaced, and the insulation resistance of the replacement conductors shall be completely retested, with no additional compensation.

END OF SECTION 260519



## SECTION 260526 – GROUNDING & BONDING

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260519 – Low-Voltage Conductors & Cables: Insulated conductors

#### 1.2 SUMMARY

- A. Provide a grounding electrode system for all separately derived systems as required by the NEC and as specified herein.
- B. Provide grounding for electrical equipment as required by the NEC and as specified herein.
- C. Provide bonding as required by the NEC and as specified herein.
- D. Provide an equipment grounding conductor in each feeder and branch circuit.
- E. Provide an isolated equipment grounding conductor in each circuit serving isolated-ground receptacles.

#### 1.3 SUBMITTALS

- A. Product Data: For ground rods, ground bars and each grounding connection device provided on the Project.

#### 1.4 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, updated to record any changes.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Insulated Grounding Conductors: Copper, as specified in Section 260519.
- B. Bare Grounding Conductors: Bare, uncoated soft-drawn copper conductor, 100% conductivity. Minimum size shall be #6 AWG. #6 AWG shall be solid; larger sizes shall be stranded.
- C. Ground Clamps: Equivalent to Burndy Type GAR-BU.

- D. Compression Connectors: Irreversible compression-type, suitable for direct burial. Burndy Hyground or Thomas & Betts Color-Keyed.

## 2.2 ACCEPTABLE MANUFACTURERS

- A. Manufacturers shall be as listed above, and as follows:
  - 1. Bare Grounding Conductors: Phelps-Dodge, Southwire, Harger
  - 2. Grounding and Bonding Connectors: Burndy, Harger, Thomas & Betts
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Grounding connections in the grounding electrode system shall use compression connectors. Compression connectors shall be installed using a hydraulically-actuated crimping tool and dies as recommended by the equipment manufacturer. Installed connectors shall have correct die designation embossed at a visible location on each connector.
- B. In addition to the number of branch circuit conductors shown on the Drawings, provide an equipment grounding conductor in each branch circuit raceway. Equipment grounding conductors shall be connected to the non-current carrying parts of the equipment or device they serve. Minimum size shall be #12 AWG.
- C. In addition to the number of branch circuit conductors shown on the Drawings and the equipment grounding conductor specified above, provide an isolated equipment grounding conductor in each branch circuit raceway serving isolated-ground receptacles. Isolated equipment grounding conductors shall be connected to the isolated-ground terminal on the receptacle. The non-isolated ground conductors shall be connected to the metallic outlet box. Minimum size shall be #12 AWG.
- D. Provide an equipment grounding conductor in feeder raceways as indicated on the Drawings.
- E. In addition to the integral bonding tape, provide an equipment grounding conductor inside full length of all flexible metal raceway and liquid-tight flexible metal raceway.
- F. The following items shall be grounded:
  - 1. The neutral point of dry-type transformers.
  - 2. The neutral point of the Owner-furnished uninterruptable power system (UPS).
- G. The following items shall be bonded to the grounding system:
  - 1. Electrical equipment enclosures
  - 2. Metallic raceways
  - 3. Non-current-carrying conductive parts of fixed electrical equipment

4. Metallic straps on wiring devices.
- H. Provide a bonding jumper between each wiring device strap and its associated outlet box.

END OF SECTION 260526

## SECTION 260529 – HANGERS & SUPPORTS

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures

#### 1.2 SUMMARY

- A. Support boxes and raceways in accordance with NEC requirements and as described herein.
- B. Supports and hangers shall comply with applicable ASCE seismic requirements.
- C. Support panelboards, transformers and miscellaneous other electrical equipment, as described herein.
- D. Support cable runway from the building structure.

#### 1.3 SUBMITTALS

- A. Product Data: None required.

### PART 2 - PRODUCTS

#### 2.1 SUPPORT MATERIALS

- A. Surface-Mounted Pipe Straps: One or two straps equivalent to Kindorf HS-100 series or Kindorf C-144 series.
- B. Channel-Mounted Pipe Straps: Equivalent to Kindorf C-105 or Kindorf C-106 single-bolt pipe straps.
- C. Lay-in Pipe Hangers: Equivalent to Kindorf C-149.
- D. Threaded Rods: Galvanized steel, minimum 9.5 mm ( $\frac{3}{8}$  in) diameter, with continuous UNC threads. Load rating shall not be less than 2,200 N (500 pounds).
- E. Steel Strut Channels: Equivalent to Kindorf B-909 galvanized steel channels with bolt holes on one side.
- F. Trapeze Supports: Steel strut channels with electrical attachment accessories and a minimum of two (2) threaded rods.

- G. Cable Supports: Supports for open cable installed above accessible ceilings shall be wide base J-hooks equivalent to Erico Caddy Cat Links
- H. Surface-Mounted Wall Supports: Steel strut channels with electrical attachment accessories.
- I. Bar Hangers: Adjustable, galvanized steel, equivalent to Raco #920 or #922.
- J. Box Brackets: Adjustable, galvanized steel, equivalent to Erico "Caddy" #TSGB.
- K. Backing: Members shall match the material and size, and be compatible with, the building components in which they are installed.

## 2.2 FASTENERS

- A. Bolts and nuts: Hexagon, galvanized steel.
- B. Washers: Locking, spring-type, galvanized steel.
- C. Lag bolts: Hexagon, galvanized steel.
- D. Anchors for after-set attachment: Galvanized steel, equivalent to Hilti epoxy, expansion anchors.
- E. Anchors for cast-in-place attachment: Galvanized steel, "L" shaped anchor bolts.
- F. Beam clamps: Galvanized steel, U-bolt with nuts and washers.

## 2.3 MANUFACTURERS

- A. Acceptable manufacturers shall be as listed above, and as follows:
  - 1. Support Devices: B-Line, Erico, Hilti, Kindorf, Raco, Thomas & Betts or Unistrut
  - 2. Velcro Wraps: Leviton
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Boxes: Fasten outlet boxes, junction boxes and pull boxes securely in place by attachment to the building structure with devices described herein. Recessed outlet boxes in framed walls or ceilings shall be supported by horizontal box brackets rigidly attached to two studs. Recessed outlet boxes in suspended ceilings shall be supported by bar hangers rigidly attached to two ceiling support channels.
- B. Raceways: Support raceways from the building structure with devices described herein. Raceways shall be supported at intervals not exceeding those required by the NEC.

Individual, suspended raceways shall be supported with individual pipe straps or pipe hangers. Individual, surface-mounted raceways shall be supported with individual pipe supports. Multiple rows of suspended raceways shall be supported from trapeze supports. Multiple runs of surface-mounted raceways shall be supported on surface-mounted wall supports. Include sway bracing.

- C. Wall-mounted Equipment: Fasten wall-mounted electrical equipment securely in place by attachment to the building structure with devices as described herein. Include concealed backing.
- D. Freestanding Equipment: Fasten free-standing electrical equipment securely in place by attachment to the building structure with devices as described herein. Floor-mounted, equipment shall be anchored to the floor with appropriate fasteners. Equipment whose vertical dimension exceeds one of its other two dimensions shall be attached to the floor and shall be attached to the building structure near the top of the vertical dimension.
- E. Dry-type Transformers: Transformer shall be supported on vibration isolation pads.
- F. Capacity: Backing, support devices and connections shall be capable of supporting a minimum of 200% of the supported weight.
- G. Connections: Threaded rods shall be connected to support devices with double washers and double nuts. Channels shall be bolted together with double washers and double nuts.
- H. Backing: Provide concealed backing behind both new and future wall-mounted equipment. Equipment shall be attached to the backing using the appropriate fasteners.
- I. Sway Bracing: Provide sway bracing for suspended supports and equipment. A minimum of two sway braces shall be provided in the same horizontal plane, 90° apart. Braces shall be steel strut channels of the appropriate size.
- J. Lateral Bracing: Provide lateral bracing for freestanding equipment whose vertical dimension exceeds its shortest horizontal dimension.
- K. Attachments to wood: Use wood screws or lag bolts.
- L. Attachments to metal: Use sheet-metal screws, bolts with lock-washers and nuts, beam clamps, or hammer-on flange clips.
- M. Attachments to masonry: Use anchors designed for the appropriate masonry unit.
- N. Attachments to concrete: Use cast-in-place anchor bolts or epoxy expansion anchors.
- O. Ceiling support wires: Do not use ceiling support wires for support of any electrical equipment.

END OF SECTION 260529

## SECTION 260531 – OUTLET BOXES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work specified in this section.
- B. Related sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260529 – Hangers & Supports: Support requirements
  - 3. Section 260532 – Pull & Junction Boxes: Use as pullboxes and junction boxes
  - 4. Section 260551 – Device Plates: Requirements for device plates
  - 5. Section 260553 – Identification for Electrical Systems: Identification requirements
  - 6. Section 262719 – Multi-Outlet Assemblies: Use for connections to such assemblies
  - 7. Section 262726 – Wiring Devices: Receptacles and switches.

#### 1.2 SUMMARY

- A. Provide outlet boxes for receptacles and switches.
- B. Provide outlet boxes for electrical, communications and electronic safety system devices.
- C. Provide outlet boxes for small equipment connections and motor connections.
- D. Provide empty outlet boxes as indicated.

#### 1.3 SUBMITTALS

- A. Product Data: None required.

### PART 2 - PRODUCTS

#### 2.1 PROHIBITED MATERIALS

- A. Sectional outlet boxes shall not be utilized.
- B. Non-metallic outlet boxes shall not be utilized.

#### 2.2 MATERIALS

- A. Standard Knockout-Type Steel Boxes: Boxes shall be galvanized pressed or welded steel, not less than 100 mm (4 in) square, with a minimum wall thickness of 1.59 mm ( $\frac{1}{16}$  in), equipped with factory-stamped circular raceway knockouts. Minimum box depth shall be 54 mm ( $2\frac{1}{8}$  in) deep, except recessed outlet boxes where the wall cavity dimensions require shallower boxes. Depths of shallow boxes shall match the wall cavity

in which the boxes are installed. Provide galvanized steel device extension rings, raised device covers or blank covers as indicated. Where square-cornered tile device extension rings are indicated, they shall be a minimum of 38 mm (1½ in) deep. Device extension rings and raised device covers shall match the devices to be installed.

- B. Smooth Steel Boxes: Boxes shall be galvanized sheet steel, formed with smooth sides and welded corners, not less than 102 mm (4 in) by 73 mm (2⅞ in), with a minimum wall thickness of 0.80 mm (1/32 in), equipped with factory-stamped twist-out openings for surface metallic raceway entry. Minimum box depth shall be 25 mm (1 in) deep. Boxes shall be finished with an enamel finish. Device openings shall match the devices to be installed. Boxes shall be suitable for installation as part of a surface metallic raceway system. Boxes for installation over flush outlet boxes shall have backplates equipped with rectangular openings to match the outlet boxes upon which they are installed.
- C. Ordinary Cast Metal Boxes: Cast aluminum or malleable iron, with a minimum wall thickness of 2.38 mm (3/32 in), equipped with integral threaded raceway hubs and mounting flanges. Minimum box depth shall be 38 mm (1½ in) deep. Cast metal boxes shall be intrinsically corrosion-resistant or shall be permanently protected inside and outside against corrosion by galvanizing or other equivalent means. Device openings shall match the devices to be installed.

## 2.3 MANUFACTURERS

- A. Acceptable manufacturers shall be as follows:
  - 1. Knockout Steel Boxes: Appleton, Bowers, Raco, or Thomas & Betts
  - 2. Smooth Steel Boxes: Hubbell, Thomas & Betts, Walker or surface raceway manufacturer.
  - 3. Ordinary Cast Metal Boxes: Appleton, OZ/Gedney or Thomas & Betts
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 REQUIRED LOCATIONS

- A. Provide a suitable outlet box for each luminaire, and for each switch, control, receptacle, jack, detector, sensor, signal and other miscellaneous device of similar nature, where such devices are wall-mounted, ceiling-mounted or suspended.
- B. Provide a suitable outlet box for each small equipment connection and motor connection, where there is not an adjacent safety switch.
- C. Provide empty outlet boxes as indicated.
- D. Outlet boxes may be used as pull and junction boxes in accordance with the requirements of Section 260532.



### 3.2 BOX SELECTION

- A. General: Boxes shall have the appropriate NEMA rating for the environment and ambient temperature in which they are installed.
- B. Concealed above accessible ceilings or behind access panels (where used as pull or junction boxes only): Standard knockout-type steel boxes with blank covers.
- C. Recessed in suspended ceilings: Standard knockout-type steel boxes with device extension rings.
- D. Recessed in framed walls or ceilings: Standard knockout-type steel boxes with device extension rings
- E. Exposed in mechanical, electrical, telecommunications and machine rooms: Standard knockout-type steel boxes with raised device covers.
- F. Exposed in exterior damp locations: Ordinary cast metal boxes.
- G. Exposed in exterior wet locations: Ordinary cast metal boxes.
- H. Telecommunications:
  - 1. Outlet boxes for telecommunications outlets shall:
    - a. Be 4-11/16-inch square and 2-1/8-inch deep
    - b. Have a minimum of one 1-1/4-inch knockout.

### 3.3 INSTALLATION

- A. Install boxes as indicated, in compliance with NEC requirements, in accordance with manufacturer's recommendations and with recognized industry practices to insure that the boxes serve the intended purpose.
- B. In finished interior locations, outlet boxes shall be recessed, flush with the wall or ceiling surface, unless otherwise indicated. Outlet boxes on existing non-masonry walls shall be installed flush in the existing walls.
  - 1. Exception: Exposed boxes are permitted in mechanical, electrical, telecommunications and machine rooms.
- C. Surface-mounted smooth steel outlet boxes shall be utilized only in conjunction with exposed raceways.
- D. Carefully layout and coordinate box locations with the work of other trades to assure that boxes are not blocked, hidden, or rendered inaccessible due to the work of other trades passing over, under, across, or in close proximity.
- E. Review the Architectural drawings for conditions affecting the exact height and location of outlets, and adjust outlet locations as necessary.

- F. Adjust the location of outlet boxes for receptacles and switches within 2 m (78 in) of the location shown on the Drawings without extra compensation if so directed by the Architect or the Architect's Consultant prior to installation.
- G. Outlet boxes for switches shall be located where shown, on the strike side of door, and shall be 150 mm (72 in) from the door casing, unless it is necessary to center the switch between a door and other construction for appearance.
- H. Where outlet boxes are used for connections to multi-outlet assemblies, the outlet boxes shall be installed so as to be concealed behind the assembly raceway in accordance with the requirements of Section 262719.
- I. Where two or more outlet boxes occur on the same wall, they shall be mounted at exactly the same height unless otherwise indicated.
- J. Where outlet boxes are shown side by side but at different heights, they shall be centered one above the other unless otherwise indicated.
- K. Where two or more of the same type devices occur adjacent to each other, provide a gang type box with a gang type cover. If the voltage between adjacent devices exceeds 300 VAC, barrier partitions shall be permanently installed in the outlet box between the adjacent device positions and separate raceway entries shall be provided. Provide barrier partitions wherever adjacent devices are to be connected to circuits at different voltages or to 277 VAC circuits on different phases.
- L. Where devices of different types occur adjacent to each other, install outlet boxes approximately 152 mm (6 in) on center so that single-gang plates are spaced approximately 25 mm (1 in) apart and two-gang plates are not touching other plates. Use B-line RBS16 bar spacer or equivalent. Verify configuration with Architect's Consultant.
- M. Outlets which are shown immediately opposite one another on two sides of a wall shall have outlet boxes located to prevent contact between the two. Nipples between outlet boxes are prohibited. Provide sound isolation putty pads equivalent to TotalSeal brand 3/16" pads with a maximum STC rating of 61. On exterior walls, encase entire backbox for an air-tight seal.
- N. Where outlet boxes are installed in a fire wall, provide 3M or equivalent fire-rated putty pads to maintain fire rating of assembly.
- O. Outlet boxes shown opposite one another on two sides of a fire-rated wall shall have 610 mm (24 in) minimum horizontal separation.
- P. No outlet box or group of outlet boxes in a single stud space of a fire-rated wall shall have a total opening area larger than 103.23 cm<sup>2</sup> (16 in<sup>2</sup>).
- Q. Where outlet boxes having a total opening area exceeding 103.23 cm<sup>2</sup> (16 in<sup>2</sup>) are installed in fire rated walls or ceilings, the boxes and openings shall be protected to maintain the fire rating of the wall or ceiling in accordance with the IBC and in a manner acceptable to the Authority Having Jurisdiction.

- R. Boxes shall be sized in accordance with the NEC to accommodate the devices installed and the quantity and size of conductors entering and leaving each box. The required size shall be provided by a single box, including device extension rings where applicable. Boxes shall not be ganged or stacked. In certain locations, depth may be limited by building conditions.
- S. Recessed boxes and device rings shall be installed such that outlet opening is plumb and the front edge of the outlet opening is flush with the finished surface or set back slightly. Set back shall not exceed 3 mm ( $\frac{1}{8}$  in).
- T. Flush ceiling and wall outlet boxes shall have a  $\frac{3}{8}$  in-18 NPS threaded fixture stud where the luminaire or other device depends on such for support.
- U. All unused openings in boxes shall be left closed. Provide knockout closures to cap all unused knockout holes where blanks have been removed. Provide threaded caps for unused hubs on cast boxes.
- V. Boxes shall be rigidly attached to the building element on which they are mounted in accordance with Section 260529 or shall be solidly embedded in concrete or masonry. Boxes shall be supported independently of the raceway system. No outlet box shall be attached to the ceiling support wires, ductwork or piping. Outlet boxes shall be attached to channels or bar hangers at locations as necessary to provide the indicated spacing.
- W. Grout or seal around recessed outlet boxes which occur in exterior building surfaces or in concrete block walls to seal the space between the box and the wall or ceiling materials.
- X. Provide identification as specified in Section 260553.
- Y. Provide device plates in accordance with the requirements of Section 260551, except where the device installed covers the entire outlet box opening.
- Z. Provide a neutral conductor in each outlet box used for a switch or other control device. Neutral conductors shall originate in the same panel as the circuit installed in the box. Unused neutral conductors shall be capped.

#### 3.4 MOUNTING HEIGHTS

- A. Outlet boxes shall be mounted at the heights indicated on the Drawings.
  - 1. Exception: In spaces where there are existing outlets, new outlets shall be mounted at the same height as existing similar outlets. Verify each condition with Architect's Consultant.

END OF SECTION 260531

## SECTION 260532 – PULL & JUNCTION BOXES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work specified in this section.
- B. Related sections:
  - 1. Section 260100 –Electrical Requirements: Product substitution procedures
  - 2. Section 260529 – Hangers & Supports: Support requirements
  - 3. Section 260531 – Outlet Boxes: Small pull boxes and junction boxes
  - 4. Section 260533 – Raceways: Requirements for pulling points due to cumulative bend limitations
  - 5. Section 260553 – Identification for Electrical Systems: Identification requirements

#### 1.2 SUMMARY

- A. Provide pull boxes and junction boxes as indicated and as required for proper installation of the raceway and wiring systems.

#### 1.3 SUBMITTALS

- A. Product Data: For concrete boxes and for boxes installed in exterior and wet locations.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Small Boxes: Boxes smaller than 820 cm<sup>3</sup> (50 in<sup>3</sup>) shall be outlet boxes as specified in Section 260531.
- B. NEMA Type 1 Formed Boxes: Formed galvanized or phosphatized sheet steel with welded seams. Boxes shall have galvanized or phosphatized sheet steel covers. Covers shall be held in place with screws unless hinged doors are indicated on the Drawings. Screw covers shall be held in place with a minimum of four (4) corrosion-resistant screws. Hinged doors shall have heavy duty hinges and latching and locking devices. Boxes and covers shall be finished inside and outside with a polyester powder finish. Knockouts shall be factory stamped or formed in the field with a cutting tool to provide clean symmetrically-cut holes. Covers on flush boxes shall overlap the adjacent surface by 19 mm (¾ in) on all sides.
- C. NEMA Type 3R Formed Boxes: Formed galvanized sheet steel with welded seams. Boxes shall have galvanized sheet steel hinged door covers, equipped with heavy-duty hinges. Boxes shall be equipped with drip-shield top and seam-free sides, front and back, to exclude entry of falling rain, sleet or snow and dripping water. Doors shall be equipped with hasps for padlocking and shall be secured by a minimum of two (2) corrosion-

resistant screws or clasps. Boxes shall be equipped with embossed mounting holes on the back side or external mounting feet. Boxes and covers shall be finished inside and outside with a polyester powder finish. Knockouts shall be factory stamped in the bottom of the enclosure or formed in the field with a cutting tool to provide clean symmetrically-cut holes.

- D. Ordinary Cast Metal Boxes: Cast aluminum or malleable iron, with a minimum wall thickness of 3.17 mm ( $\frac{1}{8}$  in), equipped with integral threaded raceway hubs and mounting flanges. Cast metal boxes shall be intrinsically corrosion-resistant or shall be permanently protected inside and outside against corrosion by galvanizing or other equivalent means. Cast metal pull and junction boxes shall have gasketed covers held in place with a minimum of four (4) corrosion-resistant screws. Covers shall be constructed of the same material as the boxes.

## 2.2 MANUFACTURERS

- A. Acceptable manufacturers shall be as follows:
  - 1. Formed Steel Boxes: Circle AW, Hoffman, Keystone or panelboard manufacturer per Section 262416
  - 2. Wireways: Circle AW, Hoffman, Keystone or panelboard manufacturer per Section 262416
  - 3. Cast Metal Boxes: Appleton, Crouse Hinds, OZ/Gedney
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 REQUIRED LOCATIONS

- A. Provide pull and junction boxes where indicated on the Drawings and wherever necessary for proper installation of the various electrical, communications, and electronic safety systems.
- B. Provide pull boxes in raceways to limit the cumulative bends between pulling points as specified in Section 260533.

### 3.2 SELECTION

- A. General: Boxes shall have the appropriate NEMA rating for the environment and ambient temperature in which they are installed.
- B. Concealed above Accessible Ceilings or behind Access Panels: Select NEMA Type 1 formed boxes, NEMA Type 1 wireways, ordinary cast metal boxes.
- C. Recessed in Suspended Ceilings: Not permitted.
- D. Recessed in Framed Walls or Ceilings: Select NEMA Type 1 formed boxes with flush covers.

- E. Exposed in Mechanical, Electrical, Telecommunications and Machine Rooms: Select NEMA Type 1 formed boxes, NEMA Type 1 wireways, or ordinary cast metal boxes.
- F. Exposed in Exterior Damp and Wet Locations: Select NEMA Type 3R formed boxes or ordinary cast metal boxes.

### 3.3 INSTALLATION

- A. Install pull and junction boxes as indicated, in compliance with NEC requirements, in accordance with manufacturer's recommendations and with recognized industry practices to insure that the boxes serve the intended purpose.
- B. In finished interior locations, pull boxes and junction boxes shall be concealed in accessible locations above suspended ceilings wherever possible. Where boxes cannot be concealed, install recessed boxes flush with the wall or ceiling surface, in locations approved by the Engineer.
  - 1. Exception: Exposed boxes are permitted in mechanical, electrical, telecommunications and machine rooms.
- C. Carefully layout and coordinate box locations with the work of other trades to assure that boxes are not blocked, hidden, or rendered inaccessible due to the work of other trades passing over, under, across, or in close proximity.
- D. Boxes shall be sized in accordance with the NEC to accommodate the quantity and size of raceways and conductors entering and leaving each box. The required size shall be provided by a single box. For boxes smaller than 820 cm<sup>3</sup> (50 in<sup>3</sup>) where the box is not recessed, the required size may be obtained by adding a single box extension, provided that no raceways connect to the box extension. Otherwise, boxes shall not be ganged or stacked. In certain locations, depth may be limited by building conditions.
- E. Recessed boxes shall be installed such that box opening is plumb and the front edge of the box opening is flush with the finished surface or set back slightly. Set back shall not exceed 3.17 mm ( $\frac{1}{8}$  in).
- F. All unused openings boxes shall be left closed. Provide knockout closures to cap all unused knockout holes where blanks have been removed. Provide threaded caps for unused hubs on cast boxes. Unused raceway openings in composite and concrete box shall be left closed.
- G. Boxes shall be rigidly attached to the building element on which they are mounted in accordance with Section 260529 or shall be solidly embedded in concrete or masonry. Boxes shall be supported independently of the raceway system. No pull or junction box shall be attached to the ceiling system, ceiling support wires, ductwork or piping.

END OF SECTION 260532

## SECTION 260533 – RACEWAYS

### 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 work specified in this section.
- B. Related sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260510 – Electrical Common Work: Sealing, firestopping, and roof flashing
  - 3. Section 260519 – Low-Voltage Conductors & Cables: Use of MC cable
  - 4. Section 260526 – Grounding & Bonding: Bonding requirements
  - 5. Section 260529 – Hangers & Supports: Support requirements
  - 6. Section 260531 – Outlet Boxes: Requirements for raceway knockouts
  - 7. Section 260532 – Pull & Junction Boxes: Requirements for pullboxes and junction boxes

#### 1.2 SUMMARY

- A. Provide raceways for wires and cables.
- B. Provide empty raceways as indicated.
- C. All raceways in finished spaces shall be concealed.
- D. Raceways for telecommunications cabling shall comply with ANSI/TIA/EIA Standards 568 and 569.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of coupling, connector and fitting provided on the Project.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Flexible Metal Conduit (FMC): Galvanized steel, interlocking, complying with Fed. Spec. WW-C-566C. Provide an internal equipment grounding conductor.
- B. Liquidtight Flexible Metal Conduit (LFMC): “Sealtite” or “Flex-Seal” with steel core and copper bonding tape and with sunlight-resistant weatherproof exterior jacket. Provide an internal equipment grounding conductor, in addition to the integral bonding tape.
- C. Electrical Metallic Tubing (EMT): Mild steel, hot-dip galvanized, complying with ANSI C80.3 and Fed. Spec. WW-C-563.

- D. Surface Metal Raceways (SMR): Galvanized or zinc-plated steel, finished with a polyester top-coat over an ivory-colored base, and suitable for field re-painting to match surrounding surfaces. Raceway shall consist of a one-piece design, with factory-assembled base and cover, having a cross-sectional area of at least 160mm<sup>2</sup> (0.248 in<sup>2</sup>). Provide all associated hardware and fittings.
- E. Connectors for FMC: Galvanized steel or zinc-plated malleable iron, clamp-down, squeeze-type, with pre-insulated bushings.
- F. Connectors for LFMC: Galvanized steel or zinc-plated malleable iron, liquid-tight, compression type, with pre-insulated bushings.
- G. Couplings and Connectors for EMT: Steel, set-screw type. Connectors shall include pre-insulated bushings. Couplings and connectors in damp or wet locations shall be rain-tight compression fittings, UL listed as suitable for wet locations.
- H. Polypropylene Pull Strings: Polypropylene tape or cord with a minimum tensile strength of 700 N (157 pounds), test.

## 2.2 MANUFACTURERS

- A. Acceptable manufacturers shall be as follows:
  - 1. EMT: Allied Tube & Conduit, National Electrical Products, Republic LTV, Triangle Conduit & Cable, Western Tube & Conduit, Wheatland Tube Company
  - 2. FMC, LFMC: AFC Cable Systems, Alflex, American Brass, Anamet, Electric-Flex
  - 3. SMR: Hubbell, Walker, Thomas & Betts
  - 4. Threaded Hubs: Crouse-Hinds, O.Z./Gedney
  - 5. Unions, Couplings, Connectors: Appleton, Bridgeport, O.Z./Gedney, Thomas & Betts
  - 6. Pull Strings: Greenlee, Ideal
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 REQUIRED LOCATIONS

- A. Provide a complete system of raceway for all wires and cables operating at 600 VAC and below.
- B. Provide raceways for communications and electronic security system circuits in accordance with the specifications for the respective systems. Where specifically permitted in the specifications section for a particular system, raceway may be omitted for segments of such circuits that consist of cables run in cable tray or above accessible ceilings composed of removable tiles, provided that where cable is installed in spaces used for air movement, the cable is plenum-rated. Otherwise, raceways shall be provided for the entire length of such circuits.



### 3.2 RACEWAY SELECTION

- A. Concealed above Ceilings: Select EMT.
- B. Exposed in Mechanical, Electrical, Telecommunications and Machine Rooms: Select EMT.
- C. Exposed Elsewhere in Interior Dry Locations: SMR.
- D. Exposed in Exterior Damp Locations: Select EMT up to 27 mm (1" trade size) with rain-tight compression fittings.
- E. Exposed in Exterior Wet Locations: Select EMT up to 2 mm (1" trade size) with rain-tight compression fittings.
- F. Connections to Motors and Other Vibrating Equipment in Interior Dry Locations: Select FMC.
- G. Connections to Motors and Other Vibrating Equipment in Damp or Wet Locations: Select LFMC.

### 3.3 GENERAL

- A. Minimum raceway size shall be 21 mm (3/4" trade size).
- B. Any minor changes in the location of raceways from those shown on the drawings shall be made without additional cost if so directed by the Engineer or the Engineer's Consultant before installation.
- C. Where a raceway enters a box or other enclosure through a knockout, steel locknuts and an insulating bushing shall be provided.
- D. The ends of all metallic raceways shall have insulated bushings.
- E. The inside radius of bends in raceways containing power and signal wires and cables shall comply with the NEC. Hickey bends may only be used for raceways smaller than 27 mm (1" trade size). Factory-manufactured elbows or bends fabricated in a bending machine shall be used for raceways 27 mm (1" trade size) and larger. The bend angle of manufactured elbows shall not be modified by cutting an elbow midway in the curved section of the fitting; connections to manufactured elbows shall be made only on the straight sections at the ends of the fitting.
- F. Flexible conduit connections to motors shall include one (1) 90° bend.
- G. Raceways shall be limited to 30 m (100 feet) in length between boxes, cabinets or other pulling points. Raceways shall be limited to the equivalent of four (4) 90° bends between boxes, cabinets or other pulling points.
- H. Multiple branch circuits indicated as separate home-runs with #12 AWG or #10 AWG conductors may be combined in a single raceway, provided that the quantity of current-carrying conductors in the raceway does not exceed nine (9) conductors for #12 AWG

and #10 AWG conductors and provided the raceway fill does not exceed 30%. For circuits with neutral conductors, both the phase conductors and the neutral conductor of each circuit shall be counted as current-carrying.

- I. Ends of raceways shall be capped during construction to prevent the entrance of foreign materials. All raceways shall be cleaned by pulling a swab through the raceway before wires and cables are installed.
- J. Branch circuit raceway runs are shown schematically. Except where exact routing is indicated, branch circuit raceways may be grouped, and the actual routing of branch circuit raceways may be altered, providing actual routing and locations are properly recorded on the Record Drawings.
- K. Raceways shall not penetrate structural members.
- L. Grout or seal around raceway penetrations through walls, ceilings or floors with an approved sealant material to provide an airtight seal, in accordance with Section 260510.
- M. Open ends of raceways which extend outside of the building perimeter shall be sealed with removable duct sealing compound at both ends.
- N. Provide a nylon pull rope in all utility service raceways, including those for future use. Leave a minimum of 610 mm (24 in) of slack at each end of raceway.
- O. New raceway installed on existing masonry walls shall be SMR and shall be painted to match the surface on which it is installed.
- P. New raceway serving outlet boxes on new or existing non-masonry walls shall be concealed with the walls.

### 3.4 INSTALLATION

- A. Raceways shall be minimum 21 mm (3/4" trade size).
- B. Raceways in electrical, mechanical, communications and elevator equipment rooms may be installed exposed. Raceways in all other areas shall be concealed, except as otherwise indicated.
- C. Where raceways are exposed or installed above accessible ceilings they shall be installed parallel with or at right angles to the building lines and shall not be installed diagonally. Exterior raceways and raceways installed in interior damp or wet locations shall be spaced at least 3mm (1/8 in) away from walls to prevent accumulation of water.
- D. Raceways shall be installed a minimum of 152 mm (6 in) from hot water and steam piping and a minimum of 457 mm (18 in) from flues. Signal and communication systems raceways shall maintain a minimum separation of 305 mm (12 in) from lighting ballasts and other sources of electromagnetic interference (EMI) such as motors, transformers, panelboards, and enclosed circuit breakers.

- E. Raceways which terminate at sheet-metal boxes or enclosures in exterior locations, or in interior damp or wet locations, shall enter through the bottom of the enclosure or shall be connected using water-tight threaded hubs. Care shall be taken not to violate the environmental rating of an enclosure by making improper raceway connections.
- F. Raceways which terminate at a sheet-metal box equipped with a box extension shall connect to the box, and not to the box extension.
- G. Provide a weatherproof roof flashing for each raceway penetrating the roof in accordance with Section 260510. Flashing shall be compatible with the roofing materials and shall not compromise the roofing warranty.
- H. Joints in raceways in wet locations shall be watertight.
- I. Where raceway passes from an exterior location to an interior location, provide a sealant to inhibit condensation and moisture migration due to temperature differences. Fill raceway with sealing compound after conductors have been installed. Compound shall prevent the transmission of vapor through the raceway system.
- J. Support raceways in accordance with Section 260529.
- K. Provide pullboxes and junction boxes in accordance with Section 260532.
- L. Bond raceways in accordance with Section 260526.

### 3.5 ADDITIONAL TELECOMMUNICATIONS RACEWAY INSTALLATION REQUIREMENTS

- A. Minimum raceway size for telecommunications raceways shall be 32 mm (1-1/4" trade size).
- B. The inside radius of bends in raceways containing telecommunications cables shall not be less than 10 times the internal diameter of the raceway. Raceways containing telecommunications cables shall be limited to the equivalent of two (2) 90° bends between boxes or cabinets. Raceways containing telecommunications cables may have the equivalent of one (1) additional 90° bend if the raceway size is increased by one trade size above the size otherwise required. Provide pull boxes in the quantities and locations necessary to comply with bend requirements. The use of 90° conduit fittings (e.g., LB's) is not acceptable in raceways for telecommunications use.
- C. Raceways for telecommunications cabling shall maintain a minimum separation of at least 51 mm (2 in) from raceways of other systems, including power, fire alarm, paging, intercommunications and sound reinforcement. No telecommunications raceway shall terminate within 305 mm (12 in) of a power circuit operating at a voltage-to-ground less than 150 V, or within 610 mm (24 in) of a power circuit operating at a voltage-to-ground of 150 V or more. Telecommunications raceways shall cross at right angles to raceways of other systems.
- D. Provide a pull string in each empty telecommunications raceway. Leave a minimum of 305 mm (12 in) of slack at each end of raceway.

END OF SECTION 260533

## SECTION 260536 – CABLE RUNWAYS

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related sections:
  - 1. Section 260100 –Electrical Requirements: Product substitution procedures
  - 2. Section 260510 –Electrical Common Work: Sleeves
  - 3. Section 260526 – Grounding & Bonding: Bonding requirements
  - 4. Section 260529 – Hangers & Supports: Support requirements
  - 5. Section 260533 – Raceways: Raceway termination requirements

#### 1.2 SUMMARY

- A. Provide a cable runway system as indicated.
- B. Provide a required hardware to support the cable runway system from the building structure. Runway shall not be supported from the accessible ceiling system.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of runway, fitting, and support provided on the Project.

### PART 2 - PRODUCTS

#### 2.1 CABLE RUNWAY

- A. General:
  - 1. The cable runway systems shall be an assembly of metallic ladder runway sections and accessories that form a rigid structural system to support cables. Cable runway shall be in compliance with the National Electrical Code, and shall be UL classified as equipment grounding conductors.
  - 2. The cable runway system shall comply with IEC 61537, with load span criteria of L/200 (to exceed standard requirements of L/100) and a Safety Factor of 1.7. Runways shall be capable of supporting an allowable working load of at least 730 N/m (50 pounds per lineal foot) when supported at intervals no greater than 1.83 m (72 in) on center.
  - 3. The cable runway shall present no sharp edges, burrs, or projections which can damage cable insulation.
  - 4. Straight sections shall be 1.8 to 3.0 meters (71 in to 118 in) in length.
  - 5. Provide all miscellaneous mounting and installation hardware including splice plates, hold-down clips and trapeze hangers. Splice plates shall be bolted type.

- B. Runway: Runway shall consist of two longitudinal tubular steel side rails between which transverse steel channel rungs are welded near the top plane of the side rails. Top of rungs shall be approximately 6 mm ( $\frac{1}{4}$  in) below the top of the side rails. Rungs shall be spaced 229 mm (9 in) on center, except where the width of the runway is 305 mm (12 in) or less, in which case rung spacing may be 305 mm (12 in) on center. Rungs shall have rolled edges and a minimum cable bearing surface at least 19 mm ( $\frac{3}{4}$  in) wide. Side rails shall have radiused edges. Cable runways shall have rust-resistant black finish.

## 2.2 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers shall be as follows:
  - 1. Cable Runway: B-Line, Chatsworth, Homoco.
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 RUNWAY SELECTION

- A. Cable runways shall be suitably sized and supported for the indicated quantity and type of cables. In no case shall the cross-sectional area of cable runway be smaller than the size indicated on the Drawings.
- B. Widths of cable runways shall be as indicated on the Drawings.
- C. Cable runways shall have 102 mm (4 in) side posts with 76 mm (3 in) loading depth. Post shall be located approximately 18-inches apart.

### 3.2 INSTALLATION

- A. Install in strict accordance with manufacturer's recommendations.
- B. Install cable runways in the location shown on the Drawings. Installation shall be coordinated with all architectural, mechanical and structural systems and equipment which share the same general location.
- C. Mount bottom of runway at constant elevation above the floor. Cable runway and fittings shall be bolted together using splice plates, bolts and nuts to provide an electrically continuous cable support system. Cable runway shall be bolted to supports. Cable runway supports shall be capable of supporting the same load as the runway. Cable runway supports shall be installed no more than 1.83 m (72 in) on center.
- D. Support cable runway systems in accordance with IEC 61537, with load span criteria of L/200 (to exceed standard requirements of L/100) and a Safety Factor of 1.7. Supports shall comply with the requirements of Section 260529.
- E. Provide grounding conductor running the length of the cable runway and cable runway system and bonded to it periodically in accordance with the requirements of Section 260526.

END OF SECTION 260536

## SECTION 260551 – DEVICE PLATES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work specified in this section.
- B. Related sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 262726 – Wiring Devices: Switches and receptacles
  - 3. Section 260923 – Automatic Lighting Control Devices: Device color.

#### 1.2 SUMMARY

- A. Provide a device plate for each wiring device, each occupied outlet box and each empty outlet box.

### PART 2 - PRODUCTS

#### 2.1 PROHIBITED MATERIALS

- A. Sectional plates shall not be used.

#### 2.2 MATERIALS

- A. Standard Thermoplastic Faceplates: High-impact thermoplastic, equivalent to P&S Sierra “SP” series.
- B. Weatherproof While-in-use Receptacle Covers: Cast aluminum with gasket, designed to mount on a horizontal single gang outlet, to meet or exceed UL requirements for wet locations while in use. Plate shall include a lockable hasp that will accept an 8 mm (0.315 in) diameter padlock shank, and shall be equivalent to Intermatic #WP1010HMC.
- C. Finish:
  - 1. Device Plates shall have white finish.

#### 2.3 MANUFACTURERS

- A. Manufacturers shall be as listed above, and as follows:
  - 1. Device Plates: P&S, Arrow Hart, Hubbell, Leviton
- B. Substitutions may be considered only when submitted in conformance with Section 260100.



### PART 3 - EXECUTION

#### 3.1 REQUIRED LOCATIONS

- A. Provide a suitable device plate for each new switch, control, receptacle, and other miscellaneous device of similar nature, where such devices do not include an integral device plate or canopy to cover the outlet box opening.
- B. Provide a blank plate for each empty outlet box, including boxes intended for future use.
- C. Provide a blank plate for each outlet box used as a pull or junction box.
- D. Provide a new device plate on each existing switch outlet box and receptacle outlet box within the project boundary.

#### 3.2 PLATE SELECTION

- A. General:
  - 1. Device plates shall be suitable for the environment in which they are installed.
- B. Exposed Outlet Boxes in Mechanical, Electrical, Telecommunications and Machine Rooms:
  - 1. Select pressed galvanized steel raised device plates of the same manufacture as the box, unless otherwise indicated.
- C. Interior Dry Locations: Select standard thermoplastic faceplates.
- D. Receptacles in Exterior Damp or Wet Locations: Select weatherproof while-in-use receptacle covers.

#### 3.3 INSTALLATION:

- A. Install device plates plumb, such that they fit tight to building surfaces.
- B. Provide new device plates on existing wiring devices indicated as being existing to remain.
- C. Provide identification as specified in Section 260553.

END OF SECTION 260551

## SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related sections:
  - 1. Section 262213 – Low-voltage Distribution Transformers: Labeling and arc flash hazard warning signs
  - 2. Section 262415 – Distribution Panelboards: Circuit directory cards and arc flash hazard warning signs
  - 3. Section 262416 – Branch Circuit Panelboards: Circuit directory cards and arc flash hazard warning signs
  - 4. Section 262816 – Enclosed Disconnect Switches: Labeling for switches

#### 1.2 SUMMARY

- A. Provide identification for new electrical equipment and devices specified in Division 26.
- B. Provide new circuit directory cards in existing panelboards whose circuits are modified by the work.
- C. Provide arc flash hazard safety warning signs on all new panelboards, all new dry-type transformers and the Owner-provided UPS.

#### 1.3 SUBMITTALS

- A. Product Data: None required.

### PART 2 - PRODUCTS

#### 2.1 PROHIBITED MATERIALS

- A. Dymo or equivalent labels shall not be utilized.

#### 2.2 MATERIALS

- A. Nameplates: Nameplates shall consist of two layers of colored laminated plastic with a contrasting color plastic core. Nameplates shall be machine engraved into the contrasting color core to provide 6.4 mm ( $\frac{1}{4}$  in) high text.
  - 1. Nameplates shall have the following colors:
- B. Printed Labels: Printed labels shall be matte white polypropylene with adhesive back designed for exterior applications. Label text shall be 4.8 mm ( $\frac{3}{16}$  in) high, black and shall be applied to the label by a thermal transfer printer.

- C. Directory Cards: Directory cards shall consist of heavy cardstock, metallic mounting frames and plastic covers. Mounting frames shall be attached to the back side of panelboard doors. Directories shall contain typewritten text indicating the circuit breaker number, type of load served and room number in which each load is located. Each circuit breaker identification shall be unique. Unused circuit breakers shall be designated with "SPARE" written in pencil. Spaces for future circuit breakers shall be left blank. Circuit designations on directory cards shall match the installed conditions with respect to loads and physical arrangement within panelboards.
- D. Wiring Color Code Schedules: Color code schedules shall be prepared using a color printer and shall be laminated between two layers of clear plastic. Schedules shall show color designation for each phase, neutral and ground of each system voltage. Schedules shall be 127 mm by 178 mm (5 in by 7 in).
- E. Wire and Cable Labels: Labels for wire and cables rated 600-VAC or less shall be prepared using a printer similar to Brady ID PAL with 3/4-inch white labels with black text.
- F. Available Fault Current Nameplates: Nameplates shall contain the available three-phase symmetrical fault current value and the available three-phase, instantaneous, asymmetrical fault current value at the equipment on which they are installed and the date the values were calculated.
- G. Arc Flash Hazard Safety Signs: Product safety signs in accordance with ANSI Standard Z535.4 requirements. At the left of each sign shall be an electrical hazard (lightning) graphic surrounded by a yellow triangle. At the top of the right side of the sign, in an orange signal word block, the signal word "Warning" shall appear together with an exclamation mark surrounded by a triangle. Underneath the signal word block, the message "Arc Flash Hazard" shall be printed on the first line, followed by "Appropriate PPE Required" on the second line. Safety signs shall be 51 mm by 102 mm (2 in by 4 in), and shall be laminated between a polyester base with an adhesive backing and a clear polyester overlay.

## PART 3 - EXECUTION

### 3.1 ARC FLASH HAZARD SAFETY SIGNS

- A. Prepare arc flash calculations for new panelboards, new dry-type transformers and the Owner-provided UPS. Calculations shall be based on existing arc flash calculations provided by the Owner.
- B. Provide arc flash hazard safety signs to match existing signs. Signs shall contain the following information:
  - 1. Arc flash protection boundary
  - 2. Incident energy exposure in calories/cm<sup>2</sup>
  - 3. Personal protective equipment level
  - 4. Voltage shock hazard
  - 5. Limited approach boundary
  - 6. Restricted approach boundary
  - 7. Prohibited approach boundary

### 3.2 PREPARATION

- A. All identification shall use the room numbers assigned by the Owner. Obtain a list of room numbers from the Owner's Representative prior to preparing identification.
- B. All identification shall use equipment designations that match those on the equipment. Verify equipment designations with the Owner's Representative prior to preparing identification.
- C. Verify text for nameplates, engraved labels, printed labels, and directory cards with the Architect's Consultant.
- D. All programmable systems shall use alpha-numeric identifiers assigned by the Owner.

### 3.3 INSTALLATION

#### A. General:

- 1. Provide identification for electrical equipment and devices as specified herein.
- 2. Attach identification in durable manner, suitable to each respective type of identification. Nameplates shall be securely fastened to equipment with two (2) cadmium-plated, self-tapping steel screws. Wiring color code schedules shall be fastened to equipment with permanent adhesive.

#### B. Switchboards and Distribution Panelboards:

- 1. Provide a nameplate for each distribution panelboard. Install nameplates on the outside of the equipment enclosures above the incoming line sections. Nameplate text shall include the equipment name as designated on the Drawings.
- 2. Provide a nameplate for each overcurrent protective device installed in the existing switchboards. Install nameplates on the outside of the equipment enclosure adjacent to each device. Nameplate text shall include name of load served as designated on the Drawings.
- 3. Provide a wiring color code schedule attached to the exterior of each distribution panelboard. Schedules shall be located adjacent to the main incoming line sections.
- 4. Provide an arc flash hazard safety sign attached to the exterior of each distribution panelboard. Signs shall be located on the outside of equipment enclosures so as to be clearly visible to qualified persons before examination, adjustment, servicing or maintenance of the equipment.

#### C. Panelboards:

- 1. Provide a nameplate for each panelboard. Nameplate text shall include the panelboard name as designated on the Drawings.
- 2. Install nameplates on the outside of panelboard enclosures above doors. On all other panelboards, install nameplates on the dead fronts, above the circuit breakers so that nameplates are not visible when the panelboard doors are closed.
- 3. Provide a directory card in each panelboard. Place directory card in holder behind plastic cover.

4. Provide a new directory card in each existing panelboard affected by the project indicating existing and revised circuits.
5. Provide a wiring color code schedule attached to each panelboard. Schedules shall be installed on the inside of panelboard doors.
6. Provide an arc flash hazard safety sign attached to the exterior of each panelboard. Signs shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing or maintenance of the equipment. On panelboards located in mechanical and electrical rooms, attach the signs on the outside of panelboard enclosures. On all other panelboards, attach the signs on the dead fronts or the back side of the panel doors, so that signs are not visible when panelboard doors are closed.

D. Dry-type Transformers:

1. Provide a nameplate on the outside, front of each dry-type transformer enclosure. Nameplate text shall include the transformer name as designated on the Drawings.

E. Disconnect Switches:

1. Provide a nameplate on the outside front of each disconnect switch enclosure. Nameplate text shall include the name of the load controlled as designated on the Drawings, and also the designation of the equipment that serves as the power source for the circuit that supplies the disconnect.

F. Junction Boxes and Pull Boxes:

1. Junction boxes and pull boxes 152 mm by 152 mm (6 in by 6 in) or smaller in unfinished areas and above accessible ceilings shall be color coded by spray painting the box inside and outside and spray painting the cover on both sides with the following colors:

a.	Fire Alarm & Detection:	Red
b.	208Y/120 VAC Power:	Unpainted
c.	480Y/277 VAC Power:	Blue
2. After painting, mark the covers of power system junction boxes and pull boxes with the panelboard name and circuit numbers. Marking shall be done with a wide-tip, permanent-ink black marker.
3. .

G. Communications Equipment and Devices:

1. Refer to Section 271511 for additional identification requirements.

END OF SECTION 260553

## SECTION 260923 – AUTOMATIC LIGHTING CONTROL DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related Sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260551 - Device Plates: Color of wall-mounted devices and plates.
  - 3. Section 260553 – Identification For Electrical Systems: Identification requirements

#### 1.2 SUMMARY

- A. Provide complete automatic lighting controls for interior lighting as indicated.
- B. Color of devices and device plates shall match device plate color specified in Section 260551.
- C. Adjust and test the lighting controls, and demonstrate operation to the Owner's Representative.
- D. Instruct the Owner's staff in operating the controls and recommended maintenance procedures.

#### 1.3 GENERAL DESCRIPTION

- A. Interior lighting occupancy-based controls shall consist of wall-mounted, dual-technology occupancy sensors.

#### 1.4 SYSTEM OPERATION

- A. Occupancy-based controls for interior lighting shall provide automatic shut-off control as indicated.
  - 1. Control interior lighting by room, with automatic controls functioning to turn off the general room lighting after a time delay when no occupant is present in the room.
  - 2. Occupancy sensors shall provide complete and proper volumetric coverage of each room within the coverage limits of the devices provided, in accordance with the manufacturer's published coverage limits. Unless otherwise indicated, the coverage pattern shall provide detection of desk activity (hand motion) for over 90% of the room area minimum, as required to accommodate all occupancy habits of single or multiple occupants at any location within each room.
  - 3. Wall switch occupancy sensors, shall include means for manual adjustment. Sensors shall have adjustable sensitivity and time-delay settings, which shall be

adjusted in each room to suit the actual room conditions. The occupancy sensors shall be adjusted such that the presence of one occupant within sight of the sensor is sufficient to keep the controls from automatically shutting off the lighting, with sufficient time-delay to allow an occupant to conduct any normal functions that may be out of sight from the sensor. Normal air movement while the room is unoccupied shall not in itself cause the occupancy sensors to remain activated.

## 1.5 SUBMITTALS

- A. Product Data: For each type of automatic lighting control device and equipment provided on the Project.

## 1.6 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, up-dated to record any changes.
- B. Operating Instructions: Supply a detailed narrative description of the operation of the lighting controls. Indicate application conditions, limitations of use, coverage patterns and adjustments. Include manufacturer's installation instructions.
- C. Maintenance Instructions: List replacement parts, including source. Indicate recommended maintenance and testing procedures and intervals. List all individual system components that require periodic maintenance. Include a service directory with names and telephone numbers to obtain service.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Wall Switch Occupancy Sensors: Decora style wiring device shall include "off" and "auto" controls, a passive infrared occupancy sensor and an indicator light that illuminates when the sensor detects occupancy. The sensor shall have a high-density 180° coverage pattern that detects walking motion within 7.3 m (24 ft) in front of the device and 3.1 m (10 ft) to either side when mounted 1.2 m (4 ft) above the floor. The device shall be arranged for manual control to switch lights on, and automatic control to switch lights off. Sensors shall have adjustable sensitivity (minimum to maximum) and time delay (30 seconds to 30 minutes) settings. Sensors shall initially be set at maximum sensitivity and 15 minutes delay. The device shall be rated for control of up to 800 Watts of ballast load at 120 VAC or 1200 Watts of ballast load at 277 VAC, and shall be compatible with compact fluorescent ballasts and electronic linear fluorescent ballasts. The device shall allow no leakage to load when in the "off" mode, and shall have no minimum load requirement. Wall switch occupancy sensors shall be equivalent to Cooper Greengate #ONW-D-1001 for one or two circuits as indicated.

### 2.2 MANUFACTURERS

- A. Acceptable manufacturers shall be as listed above, and as follows.
  - 1. Sensors: Wattstopper, Mytech, Unenco and Sensor-Switch.

- B. Substitutions may be considered only when submitted in conformance with Section 260100.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install equipment in accordance with the manufacturer's instructions in the locations indicated on the Drawings. Equipment shall be installed inside wall mounted cabinets.
- B. Coordinate the control requirements of contactors, controllers, relays and sensors to insure proper operation. Provide all necessary accessories.
- C. Provide a neutral and ground conductor to each line-voltage lighting control device.
- D. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.
- E. Mount occupancy sensors in finished spaces on flush-mounted outlet boxes.

#### 3.2 ADJUSTMENT, TESTING & DEMONSTRATION

- A. During adjustment and testing, carefully record all settings and all test results, including expected test results, actual test results, and corrective actions taken. Records shall be submitted to the Architect's Consultant and included in the Operating & Maintenance Manuals.
- B. Initial Set-up: Verify that wiring is correctly connected to each device. Adjust controls to function as specified under the description of system operation. Make initial settings of user-selectable options to set up lighting control configurations. Settings shall comply with direction received from the Architect's Consultant.
- C. Field Testing: Test all system features for proper function.
- D. Correct any deficiencies discovered as a result of the above testing, and completely retest the work affected by such corrections, with no additional compensation.

#### 3.3 ON-SITE TRAINING

- A. The training shall be conducted by technicians who are thoroughly familiar with the equipment and its features, and also with the Project. The training shall include instruction, field demonstration, and over-the-shoulder hands-on exercises. As a minimum, the training shall cover, but not be limited to, the following topics:
  - 1. General overview of lighting controls, including purpose and principle of operation.
  - 2. Control adjustments and settings.
  - 3. Operation of system controls, including over-ride switches.

END OF SECTION 260923



## SECTION 262213 – LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related Sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260510 – Electrical Common Work: Touch-up painting
  - 3. Section 260526 – Grounding & Bonding: Requirements for grounding and bonding
  - 4. Section 260529 – Hangers & Supports: Support requirements
  - 5. Section 260553 – Identification For Electrical Systems: Identification requirements and arc flash calculation requirements.

#### 1.2 SUMMARY

- A. Provide dry-type transformers as indicated on the Drawings.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of transformer provided on the Project.
- B. Shop Drawings: For each transformer provided on the Project. Shop drawings shall include transformer capacity and impedance ratings, insulation ratings, efficiency ratings, sound power levels, wiring diagrams, enclosure dimensions, assembly weights, raceway entries and access requirements.
- C. Test Reports: Record of all field test data.

#### 1.4 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, up-dated to record any changes.
- B. Maintenance Instructions: List replacement parts, including source. Indicate recommended maintenance and testing procedures, and the intervals involved for each. Include manufacturer's installation instructions.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Design Criteria: Design, construction, and installation shall comply with the following standards:
  - 1. UL 506

2. ANSI C89.2
  3. NEMA ST-20
  4. NEMA TP-1, Class 1 Efficiency Level
  5. NEC
- B. Configuration: Transformers shall be dry-type, 2-winding isolation, general purpose, quiet operating with a minimum of two (2) 2½% full-current-above-normal primary taps and two (2) 2½% full-current-below-normal primary taps. Capacity shall be as indicated on the Drawings.
- C. Voltage: Primary voltage shall be 480 VAC, 3-phase 3-wire delta. Secondary voltage shall be 120/208 VAC, 3-phase, 4-wire wye. Winding configurations shall be delta primary with grounded wye secondary for three-phase transformers.
- D. Insulation: 220°C insulation based on a 115°C (239°F) rise above a 40°C ((104°F) ) ambient at full load. Nameplate shall indicate kVA rating at 115°C (239°F) rise.
- E. Transformer Core and Winding: Cores shall be grain-oriented, silicone steel with high magnetic permeability and low hysteresis and eddy losses. Core laminations shall be tightly clamped and compressed. Coils shall be electrical-grade aluminum with continuous wound construction. Coils shall be vacuum impregnated with non-hygroscopic thermosetting varnish.
- F. Transformer Efficiency: Minimum of 94% at full load. Transformer Impedance: Minimum of 3%.
- G. Sound Levels: Quiet operating. Maximum sound power level, measured in dB shall not exceed ANSI standards. Noisy transformers shall be replaced or remounted to obtain a quiet operation, with no additional compensation.
- H. Enclosures: Rated NEMA Type 1. Transformers shall be equipped with internal vibration isolation pads.

## 2.2 MANUFACTURERS

- A. Acceptable manufacturers shall be as follows:
1. Transformers shall be equivalent to Siemens Distribution Dry-Type Transformers.
  2. Transformers shall be manufactured by Siemens, Cutler-Hammer, General Electric, Tierney and Square 'D'.
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install dry-type transformers in accordance with the manufacturer's instructions, recommendations and precautions.
- B. Mount transformers in the locations indicated on the Drawings. Maintain code-required clearances.
- C. Transformers shall not be in physical contact with walls, ductwork, piping, or other building elements, except for base and flexible conduit connection.
- D. Transformer mounts shall be rigidly attached to the building element on which they are mounted in accordance with Section 260529. Mount each transformer on external rubber-in-shear type vibration isolators. Isolators shall be designed to support 200% of the transformer weight. Provide mounting brackets for wall-mounted transformers.
- E. Remove any shipping clamps used to bypass vibration isolators internal to the transformer during shipping.
- F. Flexible metal conduit shall be used for connections to transformers installed in dry locations. Flexible raceway connections shall contain one 90° bend and shall not exceed 914 mm (36 in) in length.
- G. If paint is damaged during shipping or installation, the damaged portion shall be sanded smooth and the entire panelboard cabinet shall be repainted in accordance with Section 260510.
- H. Neatly arrange and support conductors using nylon ties or wraps, in accordance with the equipment manufacturer's recommendations.
- I. Tighten conductor lugs using a calibrated torque wrench per manufacturer's recommendations.
- J. Provide grounding and bonding connections in accordance with Section 260526 and manufacturer's installation instructions. Provide neutral-to-ground bonding jumper at each transformer.
- K. Provide a nameplate for each transformer. Identification shall comply with Section 260553.

### 3.2 ADJUSTMENT & TESTING

- A. Notify the Owner's Representative and the Architect's Consultant at least one (1) week in advance of the date of each test, to allow witnessing of the tests.
- B. Supply tools, instruments, gauges, testing equipment, protective devices and safety equipment for testing.

- C. During adjustment testing, carefully record all test results, including expected test results, actual test results, and corrective actions taken. Records shall be submitted to the Architect's Consultant and included in the Operating & Maintenance Manuals.
- D. Measure and record primary and secondary voltage values for each transformer with no connected load. After the Owner has occupied the facility, again measure and record primary and secondary voltage values, together with the load current on each phase of each transformer secondary, taking measurements at a time when the facility is operating and the transformer is loaded normally. Record the date and time when the measurements of the loaded transformer were taken.
- E. If a transformer is discovered, as a result of the above testing, to have a secondary voltage more than 3% below the nominal rated voltage, adjust the transformer taps in accordance with the manufacturer's recommendations to achieve the appropriate secondary voltage. After adjustment of the taps, re-measure and record the primary and secondary voltage values, together with the load current on each phase of each transformer secondary, again taking measurements at a time when the facility is operating and the transformer is loaded normally. Record the date and time when re-measurement of the loaded transformer took place.

END OF SECTION 262213

## SECTION 262415 – DISTRIBUTION PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related Sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260510 – Electrical Common Work: Touch-up painting
  - 3. Section 260526 – Grounding & Bonding: Bonding requirements
  - 4. Section 260529 – Hangers & Supports: Support requirements
  - 5. Section 260553 – Identification For Electrical Systems: Identification requirements and arc flash calculation requirements.

#### 1.2 SUMMARY

- A. Provide distribution panelboards as indicated.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of distribution panelboard and associated overcurrent device provided on the Project.
- B. Shop Drawings: For each distribution panelboard provided on the Project. Include arrangement of overcurrent devices, overcurrent device ratings, interrupting capacity ratings, bus ratings, enclosure dimensions, auxiliary section and skirt details, raceway entries and access requirements.

#### 1.4 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, up-dated to record any changes.
- B. Maintenance Instructions: List replacement parts, including source. Indicate recommended maintenance and testing procedures, and intervals. Include manufacturer's installation instructions.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General:
  - 1. Each distribution panelboard shall consist of the proper number of vertical sections bolted together to form a metal enclosed wall mounted structure, equipped with busbars and overcurrent devices.

2. Distribution panelboards and overcurrent devices therein shall have a minimum integrated equipment symmetrical short circuit current rating as indicated.
3. Each distribution panelboard, together with the cabinet and the units comprising the same, shall bear the manufacturer's nameplate and UL label.
4. Provide a nameplate for each distribution panelboard and for each overcurrent device within it. Where distribution panels have doors in the front panel, provide directory cardholders and directory cards inside the panelboard door. Identification shall comply with Section 260553.

B. Cabinets:

1. Cabinets and trim shall be code gauge steel with wiring gutters all around.
2. Wiring gutter on both sides shall be 203 mm (8 in) minimum, with additional width where required by code for the conductors to be connected to the overcurrent devices. Wiring gutter at top and bottom shall be sized per code for the distribution panelboard feeder conductors.
3. Cabinets for surface-mounted distribution panelboards shall extend from the floor to the top of the panelboard, with dividers, blank panels, and miscellaneous hardware as required.
4. Cabinets for distribution panelboards shall be painted with gray lacquer over rust preventative primer. Sides and top of surface mounted panelboards shall be painted to match fronts.

C. Panelboard Interiors:

1. Distribution panelboards shall include circuit overcurrent devices as indicated on the Drawings. All devices shall be connected with bus connection straps having line and load connections accessible from the front. Panelboard capacity and arrangement shall be as indicated on the Drawings.
2. Incoming main lugs or main over-current devices shall be positioned at the top or bottom of the interior of each distribution panelboard, and shall not be branch mounted.
3. Include fully-provisioned spaces for additional branch over-current devices as indicated.
4. Distribution panelboards and overcurrent devices shall have a minimum symmetrical, integrated interrupting rating as indicated. Distribution panelboards and overcurrent devices shall be rated for the indicated fault current without series rating.
5. Busing shall be rated at voltage, amperage and phase arrangement as shown on the drawings and schedules. Bus bars shall be tin-plated aluminum, sized on the basis of not more than  $116A/mm^2$  (750 amperes/square inch) current density. Bus bars shall be mounted on supports of high impact, non-tracking, insulating material. All bolted connections shall be made with Belleville washers.
6. Each multi-section distribution panelboard shall be equipped with feed-through lugs and conductors. The ampere rating of each section of a multi-section panelboard and all interconnecting conductors shall be equal to the rating of the main overcurrent device or main lugs.
7. Provide lugs to match incoming and outgoing conductor sizes indicated on the Drawings.

8. Each distribution panelboard section shall include an equipment ground bus equipped with a ground lug for each feeder ground conductor.
9. Each panelboard section shall be equipped with a ground lug for feeder ground conductor and an equipment ground bus.

D. Overcurrent Devices:

1. Circuit breakers shall be ambient-compensated, thermal-magnetic, bolt-on molded-case type, which will provide inverse time delay overload, and instantaneous short circuit protection. Branch circuit breakers shall have one, two or three poles as designated on the Drawings. Multi-pole circuit breakers shall have integral trip mechanisms. Circuit breakers utilizing handle ties for two or three pole operation are not acceptable. Interrupting capacity shall match the rating of the panelboard. Circuit breaker terminals shall be rated for 75°C (167°F) operation.

## 2.2 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers shall be as follows.

1. Distribution panelboard and protective devices shall be equivalent to I-Line Panelboards.
2. Distribution panelboards shall be manufactured by Siemens, Square 'D', Cutler-Hammer or General Electric.

B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prior to submitting shop drawings or ordering equipment, review the space available for installation of the equipment and determine whether the equipment should be top-fed or bottom-fed.

### 3.2 INSTALLATION

- A. Installation shall conform to the manufacturer's instructions, recommendations and precautions.
- B. Install distribution panelboards in the locations indicated. Mount cabinets plumb. Place top at 1.93 m (76 in) above finished floor, unless otherwise indicated. Maintain code-required clearances.
- C. Distribution panelboards shall be rigidly attached to the building element on which they are mounted in accordance with Section 260529.

- D. If paint is damaged during shipping or installation, the damaged portion shall be sanded smooth and the entire panelboard cabinet shall be repainted in accordance with Section 260510.
- E. Neatly arrange and support conductors using nylon ties or wraps, in accordance with the equipment manufacturer's recommendations.
- F. Tighten conductor lugs using a calibrated torque wrench per manufacturer's recommendations.
- G. Provide bonding connections in accordance with Section 260526 and manufacturer's installation instructions.
- H. Provide identification as specified in Section 260553.

END OF SECTION 262415



## SECTION 262416 – BRANCH-CIRCUIT PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related Sections.
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260510 – Electrical Common Work: Touch-up painting
  - 3. Section 260526 – Grounding & Bonding: Bonding requirements
  - 4. Section 260529 – Hangers & Supports: Support requirements
  - 5. Section 260553 – Identification For Electrical Systems: Identification requirements and arc flash calculation requirements.

#### 1.2 SUMMARY

- A. Provide lighting and power branch-circuit panelboards as indicated on the Drawings. Overcurrent devices shall be a molded-case circuit breakers.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of panelboard and associated overcurrent device provided on the Project.
- B. Shop Drawings: For each panelboard provided on the Project. Include arrangement of overcurrent devices, overcurrent device ratings, interrupting capacity ratings, bus ratings, enclosure dimensions, auxiliary section and skirt details, raceway entries and access requirements.

#### 1.4 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, up-dated to record any changes.
- B. Maintenance Instructions: List replacement parts, including source. Indicate recommended maintenance and testing procedures, and intervals. Include manufacturer's installation instructions.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General:
  - 1. Each panelboard shall consist of a metal-enclosed, wall-mounted structure, equipped with busbars and overcurrent devices.

2. Each panelboard, together with the cabinet and the units comprising the same, shall bear the manufacturer's nameplate and the UL label.
3. Branch-circuit panelboards and overcurrent devices therein shall have a minimum integrated equipment symmetrical short circuit current rating as indicated.
4. Provide directory cardholders and directory cards inside the panelboard door. Identification shall comply with Section 260553.

B. Cabinets:

1. Cabinet and trim shall be of code gauge steel with wiring gutters all around. Each panelboard shall be equipped with a hinged, locking door. Two keys shall be furnished with each cabinet, and all locks on all cabinets shall be keyed alike.
2. Cabinets shall be arranged for flush or surface mounting as indicated.
3. Wiring gutter on both sides shall be 102 mm (4 in) minimum. Wiring gutter at top and bottom shall be sized per code for the panelboard feeder conductors.
4. Cabinets for surface-mounted panelboards shall extend from the floor to the top of the panelboard, with dividers, blank panels, and miscellaneous hardware as required. Cabinets for panelboards shall be painted with gray lacquer over rust preventative primer.
- 5.

C. Panelboard Interiors:

1. Panelboards shall include circuit overcurrent protection devices as indicated on the Drawings. All devices shall be connected with bus connection straps having line and load connections accessible from the front. Panelboard capacity and arrangement shall be as indicated on the panelboard schedule.
2. Panelboards and overcurrent protection devices shall have a minimum symmetrical, integrated interrupting rating as indicated. Panelboards and overcurrent devices shall be fully rated for the indicated fault current without series rating.
3. Busing shall be rated at voltage, amperage and phase arrangement as shown on the drawings and schedules. Buses shall be tin plated aluminum, sized on the basis of not more than 116 A/mm<sup>2</sup> (750 amperes/ in<sup>2</sup>) current density. Bus bars shall be mounted on supports of high impact, non-tracking, insulating material. All bolted connections shall be made with Belleville washers.
4. Provide feeder lugs to match conductor sizes indicated on the Drawings.
5. Each multi-section panelboard shall be equipped with feed-through lugs and conductors. The ampere rating of each section of a multi-section panelboard and all interconnecting conductors shall be equal to the rating of the main overcurrent device or main lugs.
6. Each panelboard section shall be equipped with a ground lug for feeder ground conductor and an equipment ground bus.

D. Overcurrent Devices:

1. Circuit breakers shall be ambient-compensated, thermal-magnetic, bolt-on molded-case type, which will provide inverse time delay overload, and instantaneous short circuit protection. Branch circuit breakers shall have one, two

or three poles as designated on the panelboard schedule. Multi-pole circuit breakers shall have integral trip mechanisms. Circuit breakers utilizing handle ties for two or three pole operation are not acceptable. Interrupting capacity shall match the rating of the panelboard. Circuit breaker terminals shall be rated for 75°C (167°F) operation.

2. Circuit breakers serving air-conditioning and refrigeration equipment shall have an "HACR" label.

## 2.2 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers shall be as follows.

1. Panelboards shall be equivalent to Siemens "Sentron" Lighting Panelboards.
2. Panelboards shall be manufactured by Siemens, General Electric, Cutler-Hammer or Square 'D'.

B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Prior to submitting shop drawings or ordering equipment, review the space available for installation of the equipment and determine whether the equipment should be top-fed or bottom-fed.

### 3.2 INSTALLATION

A. Install panelboards in accordance with the manufacturer's instructions, recommendations and precautions.

B. Mount panelboards in the locations indicated on the Drawings. Place top at 1930 mm (76 in) above finished floor, unless otherwise indicated. Maintain code-required clearances.

C. Branch-circuit panelboards shall be rigidly attached to the building element on which they are mounted in accordance with Section 260529.

D. If paint is damaged during shipping or installation, the damaged portion shall be sanded smooth and the entire panelboard cabinet shall be repainted in accordance with Section 260510.

E. Neatly arrange and support conductors using nylon ties or wraps, in accordance with the equipment manufacturer's recommendations.

F. Tighten conductor lugs using a calibrated torque wrench per manufacturer's recommendations.

G. Provide bonding connections in accordance with Section 260526 and manufacturer's installation instructions.

H. Provide identification as specified in Section 260553.

END OF SECTION 262416

## SECTION 262719 – MULTI-OUTLET ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related Sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260526 – Grounding & Bonding: Bonding requirements
  - 3. Section 260553 – Identification for Electrical Systems: Identification requirements.
  - 4. Section 262726 – Wiring Devices: For receptacles installed in multi-outlet assemblies.

#### 1.2 SUMMARY

- A. Provide horizontal multi-outlet assemblies as indicated.
- B. Provide vertical multi-outlet assemblies as indicated.
- C. Provide wiring devices and mounting equipment for multi-outlet assemblies as indicated.
- D. Provide mounting equipment for telecommunications jacks and faceplates as indicated.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of multi-outlet assembly provided on the Project.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General:
  - 1. Horizontal, multi-outlet assemblies shall consist of two-piece surface-mounted raceways, with base and snap-on cover. The cover shall include provisions to accept receptacles and/or communications outlets while completely enclosing all connected wire and cable.
  - 2. Multi-outlet assemblies shall be complete with all mounting hardware, fittings, end caps, wire-feed and cable-feed provisions and wire retainers, as required for installation in the locations indicated. Where indicated, raceways shall be equipped with barriers to divide power wiring and devices from communications outlets and devices.
  - 3. Provide receptacles and communications outlets in raceway as indicated. Where the same raceway includes both receptacles and communications outlets, include a barrier to divide the raceway.

4. Provide device plates compatible with the multi-outlet assembly.
  5. Horizontal assemblies shall be pre-wired at the factory with 610 mm (24 in) wire “slack” to allow receptacles to be moved on the job site without rewiring.
  6. Where receptacles in multi-outlet assemblies are connected to two (2) branch circuits, receptacles shall be connected to alternate circuits.
- B. Horizontal Assemblies: Two-channel, equivalent to Wiremold 4000 Series. Raceway material shall be formed steel. Cross-section shall be approximately 121 mm by 44 mm (4¾ in by 1¾ in), with internal cross-sectional area of at least 4,800 mm<sup>2</sup> (7.44 in<sup>2</sup>). Device mounting brackets for Series 4000 shall be equivalent to Wiremold #V4050 with Wiremold #5507 Series device plates. Provide duplex receptacles as specified in Section 262726. Provide telecommunications jacks and faceplates as specified in Section 271511. Raceway finish shall be ivory.
- C. Vertical Assemblies: Two-channel equivalent to Hubbell Aluminum Service Poles with custom configuration.
1. Power Section:
    - a. Five (5) isolated ground, duplex receptacles with three (3) circuits. A maximum of two (2) receptacles shall be connected to a single circuit.
    - b. 3/4-inch knockout in top
  2. Communications Section:
    - a. Two (2) single-gang knock-outs.
  3. Floor connectors.
  4. Open-top communications channel.
  5. Satin aluminum finish.
  6. Length to accommodate the ceiling height indicated on the Drawings.

## 2.2 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers shall be as listed above, and as follows:
1. Multi-outlet Assemblies: Hubbell, Thomas & Betts, Wiremold.
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install multi-outlet assemblies in accordance with the manufacturer’s instructions.
- B. Where multi-outlet assemblies are shown on Architectural elevations and details, install in the indicated locations.

- C. Field measure to determine exact lengths. Assemblies shall be ordered slightly longer than the actual dimensions and field cut to the exact length. Cuts shall be made with raceway cutting tools specifically designed for cutting the base and cover of the multi-outlet assembly. Cuts shall be square with straight, clean edges.
- D. Multi-outlet assemblies shall be installed so that they are electrically and mechanically continuous. Each assembly shall be bonded to the power system equipment grounding system in accordance with Section 260526.
- E. Raceway connections to wall-mounted multi-outlet assemblies wider than 63 mm (2½ in) shall be through the base by means of outlet boxes. Outlet boxes shall be flush in the wall behind the multi-outlet assembly. Center each outlet box behind the section of the multi-outlet assembly to which it connects. Insulating bushings shall be provided on opening in back of raceway.
- F. Raceway connections to wall-mounted multi-outlet assemblies shall be through the base of the raceway without outlet boxes. Raceway shall be stubbed into the back of the multi-outlet assembly using short elbows or bushed elbows and nipples as required. Field bends are not acceptable, except in thick walls. Insulating bushings shall be provided at raceway connections.
- G. Assemblies shall be installed level and plumb and shall be coordinated with building elements and finishes. Assemblies shall fit tight to building finishes.
- H. Installation shall be complete, including all fittings, end caps, devices, device plates and wiring. At the completion of the installation, there shall be no remaining unclosed openings in the raceway.

END OF SECTION 262719

## SECTION 262726 – WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260526 – Grounding & Bonding: Bonding requirements
  - 3. Section 260551 – Device Plates: Requirements for device plates
  - 4. Section 260553 – Identification for Electrical Systems: Identification requirements
  - 5. Section 260923 – Automatic Lighting Control Devices: Wall switch occupancy sensors
  - 6. Section 262729 – Dimmer switches: Dimmer switches

#### 1.2 SUMMARY

- A. Provide wiring devices at all receptacle and switch locations indicated on the Drawings.
- B. Provide new switches and receptacles for all switches and receptacles indicated as existing to remain.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of wiring device provided on the Project.

#### 1.4 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, updated to record any changes.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Wiring Device Switches: Toggle-operated switches shall have high-strength thermoplastic or polycarbonate toggles. Except as otherwise indicated, switches shall be rated 20 Amperes, 120/277 VAC. 20 Ampere 120/277 VAC switches shall be specification grade, complying with Federal Specification WS-896, and shall be mounted on a single-gang strap.
  - 1. Standard toggle-operated switches shall be as follows:
    - a. Single-pole Switch P&S #CSB20AC1
    - b. Double-pole Switch P&S #CSB20AC2
    - c. Three-way Switch P&S #CSB20AC3



- d. Four-way Switch P&S #CSB20AC4
  - e. Momentary Contact Switch P&S #1251
- B. Wiring Device Receptacles: Receptacles shall have grounding slots and shall have high-impact, thermoplastic faces. Except as otherwise indicated, receptacles shall be rated 20 Amperes at 125 VAC. 20 Ampere 125 VAC receptacles shall be specification grade construction series, complying with Federal Specification WC-596, and shall be mounted on a single-gang strap. GFCI-type receptacles shall include protective circuits complying with the 2003 edition of UL-943, which shall disconnect power to the receptacle face if the ground-fault interrupter is disabled due to component failure, and prevent reset if line and load terminals have been reverse wired.
- 1. Standard 125 VAC NEMA 5-20R duplex receptacles shall be as follows:
    - a. Duplex P&S #CRB5362
    - b. Isolated-Ground Duplex P&S #IG5362
    - c. GFCI Duplex (5 mA) P&S #2095
    - d. Weather-Resistant GFCI Duplex P&S #2095TRWR
- C. Receptacles with weatherproof flip-lid or weatherproof while-in-use covers shall be weather-resistant ground fault interrupter (GFCI) type.
- D. Type and Color of Wiring Devices:
- 1. Switches shall have white finish.
  - 2. Receptacles connected to the UPS shall be isolated-ground type and have orange finish.
  - 3. Receptacles connected to the Panel LCD shall be standard duplex type and have red finish.
  - 4. Receptacles connected to existing circuits shall be standard duplex type and have white finish.

## 2.2 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers shall be as listed above, and as follows:
- 1. General Switches: Cooper, Hubbell, Leviton, Pass & Seymour.
  - 2. Receptacles: Cooper, Hubbell, Leviton, Pass & Seymour.
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 REQUIRED LOCATIONS

- A. Provide wiring devices of the type indicated in the locations indicated on the Drawings.

### 3.2 DEVICE SELECTION

- A. General: Wiring devices shall be suitable for the environment in which they are installed. Wiring devices shall carry the same ampere rating as the overcurrent protective devices for the branch circuits to which they are connected.
- B. Locations within 1.8m (72 in) of a Lavatory or Sink: Provide 20-amp 125 VAC receptacles. Receptacles shall be GFCI type.
- C. Other Interior Dry Locations: Provide 20-amp, 125 VAC receptacles.
- D. Exterior Damp and Wet Locations: Provide 20-amp 125 VAC receptacles. Receptacles shall be weather-resistant GFCI type. Other devices shall be as indicated.

### 3.3 INSTALLATION

- A. Mount wiring devices securely to outlet boxes, seating the devices so that the device faces are flush with or protrude slightly beyond the device faceplates. Receptacles shall be solidly mounted so that the action of inserting plugs into the receptacles does not cause them to recede. Provide washers and/or device ring extensions as required to properly seat the devices.
- B. Wiring devices shall be bonded to the grounding system as specified in Section 260526.
- C. Orient switches vertically so that when all toggles are in the down position, the controlled lighting or equipment is shut off, except as otherwise indicated.
- D. Orient receptacles vertically so that ground pin is at bottom except as otherwise indicated.
- E. Orient receptacles in interior damp or wet locations horizontally, to accommodate the weatherproof flip-lid covers specified in Section 260551.
- F. Provide a neutral conductor to each outlet box containing a switch.
- G. Provide new wiring devices for all existing switches and receptacles indicated as existing to remain.
- H. Provide device plates as specified in Section 260551.

END OF SECTION 262726

## SECTION 262729 – DIMMER SWITCHES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260526 – Grounding & Bonding: Bonding requirements
  - 3. Section 260551 – Device Plates: Requirements for device plates
  - 4. Section 265100 – Interior Lighting: Dimming ballasts

#### 1.2 SUMMARY

- A. Provide dimmer switches for fluorescent lighting at all locations indicated on the Drawings.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of dimmer switch provided on the Project.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Fluorescent Dimmers: Fluorescent dimmers shall be slider type, designed to control electronic, fluorescent, 0 – 10-VAC dimming ballasts.
  - 1. Fluorescent dimmers shall be compatible with the ballasts provided in the luminaires being controlled, and shall accommodate the full dimming range of the ballasts.
  - 2. Fluorescent dimmers shall be designed to prevent radio frequency interference.
  - 3. Fluorescent dimmers shall be equivalent to Lutron NTF-10.
- B. Cover Plates: Dimmer switches shall have white finish. Cover plates for all dimmer switches shall be white.

#### 2.2 MANUFACTURERS

- A. Acceptable manufacturers shall be as listed above, and as follows:
  - 1. Dimmer Switches: Leviton.
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Mount dimmer switches securely to outlet boxes.
- C. Dimmer switches shall be bonded to the grounding system as specified in Section 260526.

END OF SECTION 262729

## SECTION 262813 – LOW-VOLTAGE FUSES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related Sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 262816 – Enclosed Disconnect Switches: Fusible disconnect switches

#### 1.2 SUMMARY:

- A. Provide fuses for all fusible equipment.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of fuse rated 600 VAC or less provided on the Project.

#### 1.4 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, up-dated to record any changes.
- B. Maintenance Instructions: Fuse replacement recommendations. Explain fuse selection criteria. List replacement parts, including source.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General: Fuses shall be rated for the voltage where they are applied. In order to maintain coordination and selectivity between upstream and downstream fuses within the electrical distribution system, fuses shall be of the same manufacture.
- B. Class J Fuses: 1 to 600 Ampere dual-element time-delay fuses with interrupting capacity rating of 200,000 Amperes (RMS symmetrical) minimum. Class J fuses shall allow selective coordination when applied in a ratio of 2:1 between upstream and downstream fuse ratings, including Class RK1 and other Class J fuses. Include indicating feature which clearly indicates when the fuse has opened (blown). Class J fuses shall be equivalent to Bussman LPJ-SPI series or Littelfuse JTD-ID series.
- C. Class RK1 Fuses: 0.1 to 600 Ampere dual-element time-delay rejection-type fuses with interrupting capacity rating of 200,000 Amperes (RMS symmetrical) minimum. Class RK1 fuses shall allow selective coordination when applied in a ratio of 2:1 between upstream and downstream fuse ratings, including Class J and other Class RK1 fuses. Include indicating feature which clearly indicates when the fuse has opened (blown), where available. 250 VAC Class RK1 fuses shall be equivalent to Bussman LPN-RK-SPI

series or Littelfuse LLNRK series. 600 VAC Class RK1 fuses shall be equivalent to Bussman LPS-RK-SPI series or Littelfuse LLSRK-ID series.

- D. Class RK5 Fuses: 0.1 to 600 Ampere dual-element time-delay rejection-type fuses with interrupting capacity rating of 200,000 Amperes (RMS symmetrical) minimum. Fuses shall have 10 seconds time delay at 500% rated current. Include indicating feature which clearly indicates when the fuse has opened (blown), where available. 250 VAC Class RK5 fuses shall be equivalent to Bussman FRN-R-SPI series or Littelfuse FLNR/FLNR-ID series. 600 VAC Class RK5 fuses shall be equivalent to Bussman FRS-R-SPI series.
- E. Supplementary Glass-tube Fuses: 3/16 to 15 Ampere fast-acting in-line glass-tube fuses with interrupting capacity rating of 10,000 Amperes (RMS symmetrical) minimum. Supplementary glass-tube fuses shall comply with electrical performance requirements of UL Guide JDYX. Supplementary glass-tube fuses shall be equivalent to Bussman GLR series.

## 2.2 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers shall be as listed above.
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 REQUIRED LOCATIONS

- A. Provide fuses in all fusible equipment.

### 3.2 FUSE SELECTION

- A. General: Each fuse shall be of a suitable size and type to protect for the connected load. Ampere ratings shall be as indicated on the drawings, or selected in accordance with the maximum over-current protection rating of the load. Where selective coordination is indicated, maintain a ratio between the ratings of line-side and load-side fuses that is sufficient to achieve time-current selectivity. Where the withstand rating of protected equipment depends on the type of line-side fuse, provide fuses that satisfy the requirements for obtaining the indicated withstand rating.
- B. Switchboards: Select and Class J or Class R fuses for circuits rated 600 Amperes or less. Fuses shall match fuse holders in existing fusible switches.
- C. Safety switches and combination starters: Select Class RK1 fuses for non-motor circuits and Class RK5 fuses for motor circuits.
- D. Interior lighting ballasts: Select supplementary glass-tube fuses.
- E. Other locations: Select fuses in accordance with recommendations of equipment manufacturer.

### 3.3 INSTALLATION

- A. Keep fuses in manufacturer's original packaging, stored in a clean, dry, protected environment until ready for installation.
- B. Provide fuse clips and adaptors as required to match fuse type to fuseholder.
- C. Do not install fuses in equipment prior to the equipment being installed at its final location. Fuses shall not be installed in equipment prior to shipment.
- D. Install fuses in fuseholders with fuse rating visible.

END OF SECTION 262813

## SECTION 262816 – ENCLOSED DISCONNECT SWITCHES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260529 – Hangers & Supports: Support requirements
  - 3. Section 260553 – Identification for Electrical Systems: Identification requirements
  - 4. Section 262813 – Low-Voltage Fuses: Requirements for fuses

#### 1.2 SUMMARY

- A. Provide equipment and motor circuit disconnect switches at locations indicated on the Drawings, at locations required by the NEC and as specified herein.
- B. Disconnect switches are not required for cord and plug-connected equipment.

#### 1.3 SUBMITTALS

- A. Product Data: For each type and size of disconnect switch provided on the Project.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Disconnect switches shall be externally operable and shall have quick-make, quick-break electrical contacts. Handles shall clearly indicate the “on” and “off” positions and shall have provisions for padlocking in the “off”.
- B. Switches shall be mounted in code gauge steel enclosures. Switches installed indoors shall have NEMA 1 enclosures. Switches install outdoors shall have NEMA 3R enclosures.
- C. Disconnect Switches: Disconnect switches for electrically-operated equipment rated 208 VAC and higher and for motors with rated output 0.55 kW (3/4 HP) and larger shall be two or three pole fused NEMA Heavy-Duty rated, safety switches, sized to match the associated equipment or motor. Minimum rating of safety switches shall be 30 Amperes. Voltage ratings of switches shall equal or exceed circuit voltage. Safety switches shall have neutral terminal blocks. Safety switches shall have interlocks to prevent opening the cover with the switch in the “on” position and to prevent the switch from being placed in the “on” position with the cover open.
  - 1. Fusible safety switches shall have Class R, rejection-type fuseholders.



2. Fuses shall be as specified in Section 262813.
  3. Safety switches serving equipment driven by variable frequency drives shall have one (1) set of form-C auxiliary contacts.
- D. Manual Motor Starters: Disconnect switches for 120 VAC motors with rated output 0.37 kW (1/2 HP) or less shall be toggle-type, manual motor starters, equivalent to General Electric #CR101 and shall have built-in overload protection.

## 2.2 MANUFACTURERS

- A. Manufacturers shall be as listed above, and as follows:
1. Safety Switches: Cutler-Hammer, General Electric, Siemens, or Square 'D'.
  2. Manual Motor Starters: Cutler-Hammer, General Electric, Siemens, or Square 'D'.
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Installation shall conform to the manufacturer's instructions, recommendations and precautions.
- B. Install disconnect switches at the motor controller locations. Switches shall disconnect both motor and controller. If the motor is not adjacent to the controller, provide a second disconnect switch at the motor location. Ensure that adequate working space is available around equipment, in conformance to code requirements and the manufacturer's recommendations
- C. Disconnect switches shall be rigidly attached to the building element on which they are mounted in accordance with Section 260529.
- D. Fuse rating shall be selected to match the current rating indicated on the equipment or motor nameplate. When overcurrent protection ratings are indicated on the equipment or motor nameplate, fuses rating shall match the overcurrent protection ratings. Where fuse sizes or overcurrent protection ratings indicated on the equipment or motor nameplates differ from those indicated on the Drawings, provide fuses to match the nameplate rating with no additional compensation.
- E. Provide identification as specified in Section 260553.

END OF SECTION 262816

## SECTION 264313 – SURGE PROTECTIVE DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.
- B. Related Sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedure
  - 2. Section 260526 – Grounding & Bonding: Requirements for grounding and bonding
  - 3. Section 260529 – Hangers & Supports: Support requirements

#### 1.2 SUMMARY

- A. Provide Type 2 SPD units at selected panelboards as indicated.
- B. Surge protective devices shall comply with the requirements of the current version of UL 1449.

#### 1.3 WARRANTY

- A. In addition to the warranty specified in the General Conditions, the SPD manufacturer shall warranty the SPD units to be free from defects in materials and workmanship. This additional warranty shall extend for a period of at least three (3) years from the date of Substantial Completion. The warranty shall cover the full cost of all repairs and all replacement costs for the SPD unit, including parts and labor, except labor to remove and reinstall the unit and shipping expenses. The warranty shall not be pro-rated and there shall be no deductible amount. Include warranty certificate in the Operating and Maintenance Manuals.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of SPD unit included on the Project. Include dimensions and sufficient supporting data to verify the specified device ratings.

#### 1.5 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, updated to record any changes.
- B. Maintenance Instructions: List replacement parts, including source. Indicate recommended maintenance procedures, and the intervals involved for each. Indicate application conditions, limitations of use and adjustments. Include manufacturer's installation instructions.
- C. Warranty: Manufacturer's warranty certificate.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. SPD units shall be Type 2 devices, that is, they shall be transient voltage surge suppression devices that are suitable for connection anywhere on the load side of a service disconnect. Type 3 devices are unacceptable for the uses specified herein.
- B. SPD units shall be completely enclosed and suitable for mounting in the locations indicated.
- C. SPD units shall be designed to protect solidly grounded electrical distribution systems at the rated voltage and number of phases present at the point of application.
- D. SPD units shall have been tested to withstand fifteen (15) repetitive impulses at a Nominal Discharge Current ( $I_n$ ) of 20 kA while remaining functional.
- E. Devices connected to 480Y/277VAC equipment shall have Voltage Protection Ratings (VPR) for the maximum peak let-through voltage due to the specified waveforms as follows:
  - 1. UL 1449 VPR for 6 kV/3.0 kA combination impulse, line-to-ground: 1200 Volts maximum
  - 2. UL 1449 VPR for 6 kV/3.0 kA combination impulse, line-to-neutral: 1200 Volts maximum
  - 3. UL 1449 VPR for 6 kV/3.0 kA combination impulse, neutral-to-ground: 1200 Volts maximum
- F. Based on MIL-STD-220A, EMI and RFI noise rejection for a 50 Ohm system over a 100 kHz to 1 MHz bandwidth shall be:
  - 1. Normal mode: 30 dB minimum
  - 2. Common mode: 30 dB minimum
- G. Per phase surge current rating of each SPD in the line-to-neutral and line-to-ground modes shall be 150 kA minimum.
- H. The maximum continuous operating voltage of each SPD shall be at least 115% of the rated system voltage at the equipment where the unit is applied.
- I. Each SPD unit shall be marked with a short circuit current rating. The short circuit current rating shall be greater than or equal to the available fault current at the equipment where the unit is to be applied.
- J. SPD units shall have internal fusing.
- K. SPD units shall include visual indication of protection status and an audible alarm that sounds upon loss of protection status.
- L. SPD units shall be UL listed per the current edition of UL Standard 1449.

- M. SPD units shall have wiring leads for hard-wired connections to an overcurrent protective device in the equipment.

## 2.2 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers shall be as follows.
  - 1. SPD units shall be equivalent to Leviton 47000 series.
  - 2. SPD units shall be manufactured by Advanced Protection Technologies, Cutler-Hammer, Leviton, Liebert, or Square 'D'.
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Verify that the configuration of the electrical equipment to which the SPD units are to be connected allows proper device installation in accordance with these specifications and the manufacturer's instructions. Coordinate the trip ratings of overcurrent protective devices with the manufacturer's requirements. Coordinate overcurrent device locations relative to the ground and neutral wiring terminals to insure that wiring leads can be kept as short as possible. Insure that clearances between equipment cabinets allow SPD mounting in locations that minimize the wiring lead lengths.

### 3.2 INSTALLATION

- A. SPD units shall be installed at the locations indicated, in accordance with the manufacturer's instructions.
- B. Install SPD units in a manner that facilitates removal and replacement of modules and of the complete unit for maintenance.
- C. Install SPD units as close as possible to the overcurrent protection devices of the equipment to which they are connected. SPD units shall be positioned near the neutral bus and ground bus of the equipment. Units located at panelboards shall be installed immediately adjacent to surface-mounted panelboards.
- D. Connect each SPD unit to a multi-pole overcurrent protection device, to the neutral bus and to the ground bus. Minimize the length of the wiring leads. Use wiring leads that are no longer than furnished or recommended by the manufacturer. In no case shall the total length of the wiring leads exceed 900 mm (36 in) in length. The wiring lead conductors shall be bundled, twisted together and closely tie-wrapped, in order to maintain close coupling and minimize inductance. Draw the conductors directly into their connections, leaving no excess beyond that required for minimal dressing bends.
- E. The enclosure of each SPD unit shall be bonded to the equipment grounding system in accordance with the requirements of Section 260526.

END OF SECTION 264313

## SECTION 265100 – INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work specified in this section.
- B. Related Sections:
  - 1. Section 260100 –Electrical Requirements: Product substitution procedures
  - 2. Section 260526 – Grounding & Bonding: Requirements for bonding
  - 3. Section 260529 – Hangers and Supports: Luminaire support requirements
  - 4. Section 260531 – Outlet Boxes: Outlet boxes for use with certain luminaires.

#### 1.2 SUMMARY

- A. Provide luminaires, including emergency ballasts and exit signs, at all interior locations indicated on the Drawings.
- B. Adjust and aim luminaires and verify proper operation.

#### 1.3 DESCRIPTION

- A. Luminaires shall be complete with trim, mounting hardware, ballasts and lamps, and shall be suitable for the location in which they are installed.
- B. Provide all materials required to entirely complete each luminaire ready for use, in accordance with the conditions and requirements of the building construction.

#### 1.4 WARRANTY

- A. In addition to the warranty specified in the General Conditions, each manufacturer of electronic lighting ballasts, shall warranty the electronic ballasts to be free from defects in materials and workmanship. This additional warranty shall extend for a period of at least five (5) years from the date of manufacture or purchase. For items covered by such warranty, the effective date shall in no case be more than two (2) years prior to the final date of Substantial Completion for the Project. The warranty shall cover the full cost of all repairing the components or furnishing replacements in kind. The warranty shall not be pro-rated and there shall be no deductible amount. Include warranty certificate in the Operating and Maintenance Manuals.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of luminaire, ballast and lamp provided for interior lighting on the Project. Include physical description, materials and finishes, dimensions, weights, accessories, photometry data and efficiency data, as applicable.
- B. Test Reports: Record of all field test data.

- C. Training Documentation: Sign-off form and attendee sign-in sheet for the training session.

## 1.6 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, up-dated to record any changes.
- B. Maintenance Instructions: List replacement parts, including source. Indicate recommended and required maintenance and testing procedures and intervals. List all individual lighting components that require periodic maintenance. Identify features, accessory attachments, safety precautions, and procedures for cleaning, lamp replacement and adjustment. Include manufacturer's installation instructions. Detail trouble-shooting procedures, including step-by-step instructions for typical trouble symptoms. Detail waste disposal procedures, including recycling options, for compliance with government regulations covering the disposal of lamps containing mercury.
- C. Warranty: Electronic ballast and rechargeable battery component manufacturers' warranty certificates.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRES

- A. See schedule on Drawings for listing of required luminaires. Luminaires shall be complete with trim and mounting hardware.
- B. All luminaires shall bear the UL label associated with the type, location, ambient temperature and usage of the individual luminaire.
- C. Ballasts shall be completely enclosed in wiring channels arranged to permit easy access. Ballast replacement shall not require removing the luminaire from its mounting.
- D. Lamps shall be replaceable without disassembling the luminaire or removing other lamps. Lamp replacement shall not require the use of special tools.
- E. Luminaires shall have finishes applied after fabrication; luminaires manufactured with pre-painted metal are not acceptable.
- F. Luminaires equipped with doors shall be free of light leakage around the doors under normal operating conditions. Doors shall be designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in the normal operating position. Doors shall utilize spring-loaded latches on fluorescent troffers and on other luminaires that are available with such an option.
- G. Plastic lenses shall be UV-stabilized virgin acrylic. Flat plastic lenses shall be KSH-12 or equal and a minimum of 3.18 mm (0.125 in) thick. Prisms shall be square cut at 45°; round cut is not acceptable.
- H. Alzak finished louvers and reflectors shall be low iridescent type when tri-phosphor fluorescent lamps are provided.

- I. Open luminaires, louvered luminaires, and other luminaires with exposed reflective surfaces that are part of the luminaries' means of light control, shall be shipped with dust covers. Covers shall be removed after final construction zone vacuuming has been completed.
- J. Exit signs shall be internally-illuminated. Illumination of lettering on each sign shall be diffuse, with a minimum luminance of 8.6 candela/m<sup>2</sup> (2.5 foot-lambert).

## 2.2 BALLASTS

- A. Each ballasted luminaire shall be provided with a ballast of one of the types specified herein, suitable for operation of the indicated lamp type. Ballast voltage rating shall be selected to match circuit voltage.
- B. The wiring to each ballast for double-ended linear fluorescent lamps shall be equipped with push-in ballast disconnect plugs. Line-side terminals of disconnect plugs shall be guarded. Disconnect plugs shall be located within the ballast compartment.
- C. Each ballast shall be fuse protected. Fuses shall be located within the ballast compartment.
- D. Ballasts shall not contain polychlorinated biphenyls (PCB's).
- E. Electronic ballasts shall be designed to operate 1, 2, 3 or 4 lamps as required to match luminaire layout, switching and lamp quantity indicated on the drawings. Step-dimming ballasts shall illuminate all lamps in each fixture at levels of 50% and 100% light output.
- F. Linear Fluorescent Ballasts:
  - 1. 265mA ballasts for T8 lamps shall be programmed rapid-start electronic type with Class "P" rating, operating at 20 kHz or greater, and have a Class "A" sound rating. Ballasts shall have a rated minimum starting temperature no higher than 10°C (50°F). Ballasts shall have a power factor no less than 90% and a ballast factor greater than 87% per ANSI C82.11. Ballasts shall have less than 15% THD and lamp current crest factor shall not exceed 1.5.
  - 2. 0-10 VDC dimming ballasts shall be programmed-start electronic type with Class "P" rating, operating at 20 KHz or greater, and shall have a Class "A" sound rating. 0-10 VDC dimming ballasts shall be capable of controlling lamp output between 5% and 100% of rated lumens, and shall have a rated minimum starting temperature no higher than 10°C (50°F). 0-10 VDC dimming ballasts shall have a power factor no less than 95% at full light output and no less than 90% throughout the dimming range, and a ballast factor greater than 87% at full light output per ANSI C82.11. 0-10 VDC dimming ballasts shall have less than 10% THD.
- G. Compact Fluorescent:
  - 1. Ballasts for compact fluorescent lamps shall be rapid-start or programmed-start electronic type with Class "P" rating, operating at 20 kHz or greater, and shall have a Class "A" sound rating. Ballasts shall be suitable for operation of 4-pin



lamps, and shall have a rated minimum starting temperature no higher than  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ). Ballasts shall have a power factor no less than 95% and a ballast factor greater than 92% per ANSI C82.11. Ballasts shall have less than 15% THD and lamp current crest factor shall not exceed 1.7. Compact fluorescent electronic ballasts shall have an end-of-life shut-down feature to prevent ballasts from attempting to start burned-out lamps.

H. Fluorescent Emergency Ballasts:

1. Emergency ballasts shall be compatible with the lighting ballasts in the luminaires in which they are installed. Emergency ballasts shall allow all lamps to be switched off when normal power is available. When normal power fails, the emergency ballasts shall immediately energize lamps regardless of switch position. Each emergency ballast shall include an integral fully automatic, solid-state, constant-current battery charger with sealed power transfer relay and a sealed, maintenance-free, nickel-cadmium battery. Each emergency ballast shall be equipped with a push-to-test switch and a charge indicator light, both of which shall be visible and accessible without opening the luminaire or entering the ceiling space.
2. Linear fluorescent emergency ballasts shall be UL listed for factory or field installation, and shall be capable of operating one (1) 17-watt to 215-watt fluorescent lamp or two (2) 17-watt or 40-watt fluorescent lamps. Linear fluorescent emergency ballasts shall produce an initial light output of 1,000 lumens minimum when operating either one or two 32-watt T8 lamps, and shall be capable of maintaining illumination throughout a 90-minute period. Light output at the end of the 90-minute period shall not be less than 700 lumens. The linear fluorescent emergency ballast shall fit in the ballast channel of the luminaire. Test switch and indicator light shall be mounted inside the luminaire housing.
3. Compact fluorescent emergency ballasts shall be UL listed for factory or field installation, and shall be capable of operating one (1) 13-watt to 42-watt compact fluorescent lamp or two (2) 13-watt to 39-watt compact fluorescent lamps of the type and wattage installed in the respective luminaire. Compact fluorescent emergency ballasts shall produce an initial light output of 600 lumens when operating either two 26-watt quad lamps or one 32-watt triple-tube lamp and shall be capable of maintaining illumination throughout a 90-minute period. Light output at the end of the 90-minute period shall not be less than 420 lumens. Test switch and indicator light shall be installed on a single-gang plate.

2.3 LAMPS

- A. All luminaires shall be complete with lamps. Where applicable, lamps shall be of one of the types specified herein. All other lamps shall be as required by equipment in which they are installed or as indicated on the Drawings.
- B. Linear Fluorescent:
  1. T8, 265 mA: Rated for 16,000 hour life minimum. Color temperature shall be  $3500^{\circ}\text{K}$ , with color rendering index of 82 CRI minimum. 32-watt 1220 mm (48 in) lamps shall produce a minimum of 2900 initial lumens. Lamps of other

wattages shall be of the same series. Lamps shall yield no more than 0.2 mg per liter (0.026 ounce per gallon) of mercury when tested for low mercury content in accordance with the U.S. Environmental Protection Agency's Toxic Characteristic Leaching Procedure, and shall pass the California test for Total Threshold Limit Concentration of 20PPM of mercury maximum.

C. Compact Fluorescent:

1. CFT Twin Tube: 4-pin type where operated by electronic ballasts, rated for 10,000 hour life minimum. Color temperature shall be 3500°K, with color rendering index of 80 CRI minimum. 13-watt 180 mm (7 in) lamps shall produce a minimum of 825 initial lumens. Lamps of other wattages shall be of the same series.

2.4 ACCEPTABLE MANUFACTURERS

A. Manufacturers of luminaires and poles shall be as indicated on the luminaire schedule.

B. Manufacturers of ballasts and lamps shall be as follows:

1. Ballasts for linear fluorescent T8 lamps – Osram/Sylvania, Advance or MagneTek.
2. Ballasts for compact fluorescent lamps – Osram/Sylvania, Advance or MagneTek.
3. 0-10 VDC dimming ballasts for fluorescent lamps – Advance “Mark VII” series.
4. Linear fluorescent emergency ballasts – Bodine “B50” or “B50LP” Series or Iota “I-80” or “ISL-80” Series.
5. Compact fluorescent emergency ballasts – Bodine “B94C” Series or Iota “I-42” Series.
6. Linear fluorescent lamps – Osram/Sylvania, General Electric or Philips.
7. Compact fluorescent lamps – Osram/Sylvania, General Electric or Philips.
8. Ballast disconnect plugs – Ideal “Power-Plug” Series.

C. Substitutions may be considered only when submitted in conformance with Section 260100.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install luminaires in accordance with the manufacturer's recommendations and installation details.

B. Provide backboxes matched to luminaires. Where luminaires are suspended from ceiling grids, provide special interface outlet boxes designed to mount on grid members and facilitate power cable interface at the suspension point canopy, such that the power cable neither lies exposed above the ceiling nor runs in raceway. In other locations, where luminaire manufacturer's installation instructions indicate use of standard outlet boxes, boxes shall be in accordance with Section 260531. Back boxes shall be plumb and perfectly aligned.

- C. Mount interior luminaires at locations indicated on the drawings. Support luminaires in accordance with Section 260529, in the following manner:
  - 1. Mount suspended stem supported luminaires on swivel hangers which are a standard catalog item of the same manufacture as the luminaire. Support from fixture stud, or as otherwise recommended by the manufacturer. For linear luminaires, provide one more hanger than the number of luminaires in the row. Coordinate degree of swivel with the ceiling slope. Other suspension methods may be considered in mechanical type rooms where approved by Architect's Consultant.
  - 2. Mount surface and wall luminaires square with the room. Support from fixture stud or as otherwise recommended by the manufacturer. Attach surface luminaires at two (2) support points, minimum. Provide 38mm (1½ in) metal spacers for luminaires which occur on combustible ceilings. Submit spacer for approval.
  - 3. Install recessed luminaires in suspended acoustical ceiling systems in accordance with the provisions of ASTM C636. Verify all ceiling types and ceiling thicknesses to ensure that recessed luminaires can be properly installed. Provide plaster frame mounting kits where recessed luminaires are to be installed in hard ceilings.
- D. Verify all measurements. Luminaires must fit in place in a regular, trim and workmanlike manner, to the satisfaction of the Architect's Consultant. Verify the type of ceiling system in every room or space to ensure that the luminaires are compatible before releasing orders for luminaires. Incorrectly ordered luminaires shall be replaced, with no additional compensation.
- E. Verify luminaire locations with the Architectural reflected ceiling plans and interior wall elevations, when such plans and elevations are included in the Contract Documents.
- F. All recessed luminaires installed in accessible ceilings shall be connected by means of a flexible raceway or fixture whip which is attached to a 100 mm (4 in) square junction box. Box may serve more than one luminaire.
- G. Provide bonding connections in accordance with Section 260526 and manufacturer's installation instructions.
- H. After installation, all visible labels shall be removed from luminaires.
- I. Immediately prior to occupancy, clean reflectors, aperture plates, lenses, louvers, luminaire housings and decorative elements. To prevent static buildup on lenses and reflectors, clean with a manufacturer's recommended water-diluted solution of glass cleaner and allow to air-dry after installation.
- J. Broken or defective parts shall be replaced, with no additional compensation.

END OF SECTION 265100

## SECTION 271511 – COMMUNICATIONS STRUCTURED CABLING SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work specified in this section.
- B. Related Sections:
  - 1. Section 010300 – Alternates: Alternate Bid for structured cabling
  - 2. Section 260100 – Electrical Requirements: Product substitution procedures
  - 3. Section 260526 – Grounding & Bonding: Bonding requirements
  - 4. Section 260529 – Hangers & Supports: Support requirements
  - 5. Section 260531 – Outlet Boxes: Outlet boxes for certain devices
  - 6. Section 260533 – Raceways: Raceway requirements
  - 7. Section 260553 – Identification For Electrical Systems: Identification requirements
  - 8. Section 262719 – Multi-outlet Assemblies: For telecommunication devices in vertical multi-outlet assemblies.
  - 9. Section 262726 – Wiring Devices: Color of wiring devices

#### 1.2 SUMMARY:

- A. Under the Basic Bid, provide outlet boxes and raceway for a copper structured cabling system as indicated on the Drawings.
- B. Under the Base Bid, provide an optical fiber riser cable, including terminations and testing, as indicated on the Drawings.
- C. Under Alternate Bid, provide a complete telecommunications copper structured cabling system for transmission of voice and data signals from designated termination points to workstation outlets as indicated on the Drawings.
- D. The Owner will provide coaxial antenna cabling for existing radio equipment under a separate contract. Coordinate the work specified herein with the installation of the antenna cabling.
- E. Install telecommunications enclosure and light interconnection units furnished by the Owner.
- F. Test the system performance of all cables whether installed under Base Bid or Alternate Bid.

#### 1.3 DESCRIPTION

- A. System shall include, but not be limited to innerducts, riser cables, horizontal station cables, cable terminations, terminal blocks, patch panels, telecommunications outlets and

accessories as required to form a complete and functional system, ready for use. Provide associated cable supports, grounding and bonding.

- B. System shall be ready for connection of Owner-provided switches and other similar active electronic equipment for data communications.
- C. Materials and installation shall conform to the requirements set forth in the latest editions of EIA/TIA Standards 568, 569, 570, 606 and 607 and the recommendations contained in associated technical service bulletins.
- D. Terminations of horizontal unshielded twisted-pair cable shall conform to the EIA/TIA T-568B wire map configuration. Verify configuration with Owner prior to ordering materials.
- E. Provide proper identification and labeling of all telecommunications media, devices and equipment included in this Project, in accordance with the Owner's direction.
- F. Conduct performance testing of all telecommunications media specified herein.

#### 1.4 QUALIFICATIONS OF SYSTEM INSTALLER

- A. The System Installer shall be trained and certified by the manufacturer of the equipment, devices and cable provided on this project, as required to offer the system warranty as specified herein. The training shall cover all aspects of installation and testing. Personnel who have not completed the requisite training shall not be employed by the System Installer for cable termination or testing purposes. Such personnel may assist in installation of equipment, devices and cable (exclusive of termination and testing), provided the work is performed under the direct supervision of trained personnel.
- B. The System Installer shall be an organization specializing in installation of control-voltage systems and having the equivalent of 5 years experience in installing telecommunications structured cabling systems similar in scope and complexity to the system required for this Project. The organization shall own and maintain tools and equipment necessary for successful installation and testing of the system, and shall employ factory-trained technicians skilled in installation of telecommunications systems and adequately trained in the use of such tools and equipment. The technicians shall be licensed as required by the local jurisdiction to perform work on control-voltage systems, and shall have successfully installed at least one (1) other telecommunications structured cabling system of the same type, size, complexity and manufacturer as that provided for this Project. The previously installed system shall have been in operation for at least 18 months. Furnish references with submittals to document the following:
  - 1. The name of the System Installer to be employed on this Project.
  - 2. A technical resume of experience for the technician who will be responsible for installation of telecommunications equipment, devices and cable, including terminations on this Project.
  - 3. Information regarding at least one (1) project where the named technician was responsible for installation of a telecommunications structured cabling system of the same type, size, complexity and manufacturer as that provided for this project. The system shall have been in operation for at least 18 months. Identify

the manufacturer and model of the amplification equipment installed, as well as the project name, location, date of completion and owner. Furnish name and telephone number of the owner's representative for that project, to serve as a reference.

4. A list of all telecommunications structured cabling system installations completed by the organization within the past 5 years. Describe each installation in a manner that allows comparison to this Project. Include name and telephone number of the owner's representative for each project, to serve as a reference.

## 1.5 WARRANTY AND REGISTRATION

- A. In addition to the warranty specified in the General Conditions, the manufacturer of the telecommunications equipment, devices and cable shall warranty the entire telecommunications structured cable system to be in compliance with applicable codes and standards, and to be free from defects in materials and workmanship. The extended warranty shall apply to all passive structured cabling system components, and shall cover failure of the system to support applications in accordance with the performance levels stipulated in the referenced TIA/EIA standards. This additional warranty shall extend for a period of at least fifteen (15) years from the date of final field testing and acceptance of the system, and shall cover the full cost of all repairs and all replacement costs for the entire system. Include warranty certificate in the Operating and Maintenance Manuals.
- B. Upon successful completion of the installation and subsequent inspection by the manufacturer's project manager, the manufacturer of the telecommunications equipment, devices and cable shall register the telecommunications structured cable system installation, and shall furnish a numbered registration certificate to the Owner. Include copies of the certificate in the Operating and Maintenance Manuals.

## 1.6 SUBMITTALS

- A. Installer Qualifications: For Telecommunications Cable System Installer.
- B. Product Data: For all equipment, devices, cables, labels and support devices provided on the Project.
- C. Shop Drawings: Floor plans showing identification of each outlet, telecommunications room equipment placement plans, telecommunications room wall elevations and equipment rack layouts.
- D. Meeting Minutes: For pre-installation meeting.
- E. Test Summary: Summary of field test results.

## 1.7 INFORMATION FOR OPERATING AND MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, up-dated to record any changes.
- B. Test Reports: Record of all field test data.

- C. Operation Instructions: Supply a detailed narrative description of the system operation. Indicate expansion capability, application conditions and limitations of use. Include manufacturer's installation and operating instructions.
- D. Maintenance Instructions: List replacement parts, including source. Indicate recommended maintenance and testing procedures, and the intervals involved for each. List all individual system components that require periodic maintenance. Detail troubleshooting procedures. Furnish service directory with names and telephone numbers to obtain service.
- E. Registration Certificate: Manufacturer's installation registration certificate.
- F. Warranty: Manufacturer's warranty certificate.

## PART 2 - PRODUCTS

### 2.1 MATERIALS NOT INCLUDED

- A. Active network equipment.
- B. Computer software.

### 2.2 MATERIALS

- A. Configuration: All multi-pair wiring jacks shall conform to a consistent pin-out configuration. Confirm the pin-out configuration with the Owner's Representative prior to ordering products, and verify that catalog numbers correspond with the correct pin-out configuration.
- B. Cable Terminations:
  - 1. Lightguide Interconnection Units (LIUs):
    - a. Furnished by the Owner for installation under this Section of the Specifications.
  - 2. Patch panels for Multi-pair Category 6A Horizontal Station Cables:
    - a. 24-port or 48-port capacity
    - b. Category 6A compliant
    - c. Rack-mounted
    - d. With label holders and color-coded labels
    - e. With retaining trough mounted underneath each patchpanel
    - f. Equivalent to Leviton #6A586-Uxx Series
- C. Telecommunication Station Outlets:
  - 1. Single-Gang Faceplate:
    - a. 6-port capacity
    - b. White finish

- c. With port identification
- d. With quantity of jacks indicated on Drawings
- e. With blank inserts for all unused ports
- f. Equivalent to Leviton #42080-6\*S

2. Multi-pair Telecom Jacks:

- a. 8-pin RJ-45 insulation displacement modular type
- b. Category 6A compliant
- c. Equivalent to Leviton #6110G-R\*6

3. Multi-mode Fiber Optic Jack:

- a. "LC" connector type
- b. Equivalent to Leviton #41085-ML

D. Telecommunications Enclosures:

- 1. Furnished by the Owner for installation under this Section of the Specifications.

2.3 WIRE AND CABLE

- A. General: Grounding conductors shall be minimum #6 AWG. All wire and cable shall be suitable for Power-Limited Communications Circuit use. Minimum insulation rating shall be 300 VAC. Multi-pair, UTP cable shall be rated CMP. Fiber-optic cable shall be rated OFNP. Cable installed in environmental air spaces shall be plenum rated. Comply with standard EIA color coding.
- B. Multi-pair Horizontal Station Cable: Unshielded #24 AWG twisted-pair UTP cable with over-all jacket. UTP cable shall be 4-pair. Performance shall comply with Category 6A standards. UTP cable shall be equivalent to Superior Essex 10Gain Category 6A cable.
- C. Fiber-optic Riser Cable: Tight-buffered cable with twelve (12) multi-mode fibers, a dielectric strength member and an over-all jacket. All fibers shall be Corning glass. Multi-mode fibers shall be 62.5/125  $\mu\text{m}$ , with a maximum cable attenuation rating of 3.5 dB/km at 850 nm and 1.0 dB/km at 1300 nm, and with minimum bandwidth of 220 MHz-km at 850 nm and 500 MHz-km at 1300 nm. Optical fiber cable shall be equivalent to Superior Essex Single Unit Distribution cable.

2.4 INNERDUCT

- A. Innerducts shall be corrugated plastic, designed to facilitate low-friction installation of fiber-optic cables. Innerducts shall be free of "reel memory" that can cause spiraling in conduit. Innerducts shall be plenum-rated, constructed of polyvinylidene fluoride (PVDF).

2.5 CABLE LUBRICANTS

- A. Lubricants specifically designed for installing telecommunications cable shall be used to reduce pulling tension as necessary when pulling cable into conduit.



## 2.6 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers shall be as listed above, and as follows.
  - 1. Devices: Leviton, Ortronics, Panduit, Siemon
  - 2. Multi-pair Cable: Belden, Berk-Tek, CommScope, General Cable, Superior Essex.
  - 3. Fiber-optic Cable: Belden, CommScope, Superior Essex.
  - 4. Innerduct: Endot.
  - 5. Cable Lubricant: Dyna-Blue, American Polywater, or Yellow 77.
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prior to beginning rough-in for the telecommunications cabling, arrange a pre-installation meeting on the site between all parties involved in the telecommunications cable system installation, including the Owner's Information Technology Representative, the Telecommunications Cable System Installer and the Electrical Systems Installer. All parties shall review the telecommunications cable system shop drawings, the manufacturer's installation instructions, applicable regulations and any site conditions pertinent to installation of the telecommunications cable system.
- B. Prepare minutes of the pre-installation meeting and distribute them to all parties in attendance at the meeting, and to the Owner's Representative and the Architect.

### 3.2 INSTALLATION – GENERAL

- A. Install the telecommunications cable system in accordance with the manufacturer's recommendations. Locate equipment and devices as indicated.
- B. Provide back-boxes matched to the device or equipment. Where manufacturer's installation instructions indicate use of standard outlet boxes, boxes shall be in accordance with Section 260531. Install plumb and aligned with building elements.
- C. Attach racks, cabinets, and backboxes securely to the building structure in accordance with Section 260529.
- D. Provide bonding connections in accordance with Section 260526 and manufacturer's installation instructions.
- E. Cables shall not be painted either directly or with overspray.
- F. Within walls, cable shall be installed in metallic raceways.
- G. Outside of telecommunications equipment rooms or enclosures, cable shall be installed in metallic raceways or above accessible ceilings and supports specified in Section 260529.

- H. Raceways shall conform to the requirements of Section 260533, and shall be bonded to the power system ground.
- I. Visually inspect cable prior to installation. Cable with faulty insulation or outer jackets shall not be used.
- J. Terminations shall be made in a neat and workmanlike manner. Installation and termination of cable shall conform to the applicable requirements and recommendations contained in the referenced EIA/TIA standards.
- K. All terminations, patchpanels and outlets shall be clearly and logically labeled in accordance with the requirements in Section 260553. Each end of each cable shall be labeled. Each cable label shall be unique.
- L. Provide equipment identification in accordance with Section 260553.

### 3.3 INTERIOR TELECOMMUNICATIONS CABLING

- A. Mount lightguide interconnection units (LIUs), patchpanels, wire-management hardware and other rack-mounted equipment in equipment racks as indicated. Each LIU and each patchpanel shall have a retaining trough mounted immediately below it for organizing patch cords.
- B. Riser cables shall extend from the existing equipment racks to the new equipment cabinet in an uninterrupted continuous run, without intermediate splices.
- C. Horizontal station cables shall extend from the telecommunications enclosure (TE) to the outlet locations in uninterrupted continuous runs, without intermediate splices. Cables shall be free from shorts or grounds. Station cables shall terminate on the back side of patchpanels in the telecommunications enclosure. Maximum station cable length shall not exceed 91 m (300 ft). Maximum total length including patch cords shall not exceed 99 m (326 ft).
- D. Cables shall be routed so as to maintain a separation of at least 610 mm (24 in) from all heat sources and from ballasts, transformers, dimmers and other sources of electromagnetic interference. Avoid exposed cables in occupied areas or in areas where they might be damaged as a result of normal use of the area. Where two (2) or more cables run in parallel, they shall be bundled with cable ties.
- E. Cables run exposed in ceiling cavities shall be supported by means of cable support devices specified in Section 260529 which are in turn supported from the building structure. Cables shall not lie upon the ceiling, nor be supported from the ceiling frame, ceiling suspension wires, conduits, pipes, ductwork or lights. Supports shall be spaced no further apart than 1.5 m (5 ft) on center.
- F. Care shall be exercised during cable installation not to damage cable insulation. Damaged cables shall be removed and replaced. Over tightening of tie wraps is unacceptable. Type and spacing of supports shall ensure that cable will not kink, sag or distort. The minimum bend radius recommended by the cable manufacturer shall be observed in all cases.

- G. In each cable that terminates at an outlet, provide 305 mm (12 in) of slack cable, neatly coiled, to facilitate future modifications.
- H. Terminations shall be made in a neat and workmanlike manner. Terminate each horizontal station cable on a dedicated telecommunications outlet. Unless otherwise indicated, do not create multiple appearances of the same cable at several distribution points, referred to as bridged taps. Maintain the twist of horizontal station cable pairs up to the point of termination. In no case shall wire be untwisted beyond 13 mm (½ in).

### 3.4 MOUNTING HEIGHTS

- A. Back boxes shall be mounted at the heights indicated on the drawings. Where not otherwise indicated, telecommunications outlets shall be mounted at the same height as the adjacent receptacle outlets.

### 3.5 IDENTIFICATION

- A. Workstation labeling shall consist of an alphanumeric designation as directed by the Owner. Each end of each cable shall be labeled. Each workstation jack shall be labeled with an alphanumeric designation corresponding to the associated cable.
- B. Labeling of ports at patch panels shall match work station labeling.
- C. Arrangement and labeling of the ports shall follow a numerical sequence from room to room.

### 3.6 TESTING

- A. Notify the Owner's Representative and the Architect's Consultant at least one (1) week in advance of the date of each test, to allow witnessing of the tests.
- B. Supply tools, instruments, gauges, testing equipment, protective devices and safety equipment for testing.
- C. During testing, carefully record all test results, including expected test results, actual test results, and corrective actions taken. Records shall be included in the Operating & Maintenance Manuals. A summary of the test results shall be submitted to the Architect's Consultant.
- D. Test all system multi-pair riser cable after installation and prior to connection to equipment. Tests to be performed shall include, but not be limited to, the following:
  - 1. Termination order
  - 2. Conductor continuity
  - 3. Freedom from shorts and grounds
  - 4. D.C. insulation resistance
  - 5. Shield ground continuity
- E. Test all system multi-pair horizontal station cable after installation and prior to connection to equipment. Test procedures shall be based on TIA-568-B1.2-1 UTP tests

and shall be performed using a commercial Level 3 cable pair tester, equipped with compact flash memory. The tester shall capture full data plots up to 350 MHz. Data collected shall be downloaded and stored in database format for ready comparison to future standards. All 4-pair UTP cable shall meet all Category 6A UTP performance parameters per TIA-568-B1.2-1. Tests to be performed shall include, but not be limited to, the following:

1. Termination order (wiremap)
  2. Conductor continuity
  3. Freedom from shorts and grounds
  4. Impedance (length)
  5. Attenuation
  6. Near-end crosstalk (NEXT)
  7. Power sum near-end crosstalk (PSNEXT)
  8. Equal-level far-end crosstalk (ELFEXT)
  9. Power sum equal-level far-end crosstalk (PSELFEXT)
  10. Return loss (RL)
  11. Propagation delay (PD)
  12. Delay skew (DS)
  13. Longitudinal Conversion Loss (LCL)
  14. Longitudinal Conversion Transmission Loss (LCTL)
- F. Test all multi-mode fiber-optic cable after installation and prior to connection to equipment, using the correct connectors and adapters. Tests shall be conducted using a power meter. Measure and record power attenuation in each strand of each optical fiber cable.
- G. Each strand of each multi-mode fiber shall meet the following performance level for the graded parameters of attenuation and information capacity:
1. Using a wavelength of 850 nm, the maximum attenuation of 3.7 dB/kilometer shall not be exceeded. The fiber shall have information transmission bandwidth of 200 MHz-kilometer minimum.
  2. Using a wavelength of 1300 nm, the maximum attenuation of 1.5 dB/kilometer shall not be exceeded. The fiber shall have information transmission bandwidth of 1000 MHz-kilometer minimum.

END OF SECTION 271511

## SECTION 275113 – PAGING SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work specified in this section.
- B. Related Sections:
  - 1. Section 260100 – Electrical Requirements: Product substitution procedures
  - 2. Section 260526 – Grounding & Bonding: Bonding requirements
  - 3. Section 260529 – Hangers & Supports: Support requirements
  - 4. Section 260531 – Outlet Boxes: Outlet boxes for certain devices
  - 5. Section 260533 – Raceways: Raceway requirements
  - 6. Section 260553 – Identification For Electrical Systems: Identification requirements

#### 1.2 SUMMARY

- A. Relocate existing paging equipment as indicated on the Drawings. Provide new cabling to extend existing circuits to relocated equipment.
- B. Provide new ceiling-mounted speakers and wall-mounted volume controls at the locations indicated on the Drawings.
- C. New speakers and volume controls shall match the existing equipment.

#### 1.3 QUALIFICATIONS OF SYSTEM VENDER

- A. The System Vender shall be a factory-authorized dealer/distributor for the paging system equipment manufacturer, with the capability of offering factory-certified service at the Project site, both during and after the warranty period.
- B. The System Vender shall employ factory-trained technicians skilled in maintenance of paging systems, and shall maintain a service organization with spare parts in stock within 100 km (60 miles) of the Project site. The service organization shall be licensed as required by the local jurisdiction to perform work on control-voltage systems. The service organization shall have the equivalent of 5 years experience in servicing similar systems, and shall be capable of responding to service calls within 24 hours. Furnish references upon request.

#### 1.4 QUALIFICATIONS OF SYSTEM INSTALLER

- A. The System Installer shall be an organization specializing in installation of control-voltage systems and having the equivalent of 5 years experience in installing sound reinforcement systems similar in scope and complexity to the system required for this project. The organization shall employ factory-trained technicians skilled in installation of paging systems. The technicians shall be licensed as required by the local jurisdiction

to perform work on control-voltage systems, and shall have successfully installed at least one (1) other sound reinforcement system of the same type, size, complexity and manufacturer as that provided for this Project. The previously installed system shall have been in operation for at least 18 months. Furnish references with submittals to document the following:

1. The name of the System Installer to be employed on this Project.
2. A technical resume of experience for the technician who will be responsible for installation of sound reinforcement equipment, devices and cable, including terminations on this Project.
3. Information regarding at least one (1) project where the named technician was responsible for installation of a paging system of the same type, size, complexity and manufacturer as that provided for this project. The system shall have been in operation for at least 18 months. Identify the manufacturer and model of the amplification equipment installed, as well as the project name, location, date of completion and owner. Furnish name and telephone number of the owner's representative for that project, to serve as a reference.
4. A list of all paging system installations completed by the organization within the past 5 years. Describe each installation in a manner that allows comparison to this Project. Include name and telephone number of the owner's representative for each project, to serve as a reference.

#### 1.5 SYSTEM OPERATION

- A. The existing paging functions shall remain. New equipment shall be connected to existing, adjacent paging zones and shall operate the same as the zone to which it is connected.

#### 1.6 SUBMITTALS

- A. Product Data: For each type of paging equipment, device and cable provided on the Project.
- B. Meeting Minutes: For pre-installation meeting.

#### 1.7 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, up-dated to record any changes.
- B. Operating Instructions: Supply a detailed narrative description of the system operation. Indicate expansion capability, application conditions and limitations of use. Include manufacturer's installation and operating instructions.
- C. Maintenance Instructions: List replacement parts, including source. Indicate recommended maintenance and testing procedures, and the intervals involved for each. List all individual system components requiring periodic maintenance. Detail troubleshooting procedures. Include a service directory with names and telephone numbers for use in obtaining service.

## PART 2 - PRODUCTS

### 2.1 MATERIALS:

- A. Paging Loudspeakers: 203 mm (8 in), with 8-ohm nominal input impedance and matching transformer for 70 VAC input. Power rating shall be 8 watts RMS, minimum. Frequency range shall be 65-15,000 Hertz, minimum. Paging loudspeakers shall be equivalent to Rauland #ACC1400.
- B. Loudspeaker Transformers: 8-Ohm type matched to loudspeaker, suitable for connection to 25/70 VAC lines. Minimum RMS power handling rating shall be 8 watts with multiple taps. Frequency response shall be better than  $\pm 1.0$  dB in the range of 70-15,000 Hertz.
- C. Backboxes and Grilles: For paging loudspeakers except those in the gymnasiums, provide 11-gauge perforated round grille backbox with acoustic padding, equivalent to Rauland #ACC1000 grille and #ACC1101 backbox.
- D. Volume Controls: Rotating attenuators with indexed sound levels and stainless steel device plate.

### 2.2 CABLE

- A. General: All cable shall be suitable for Class 2 Circuit use. Minimum conductor size shall be #18 AWG. Cable shall be rated CL2, CL2R or CL2P. CL2 cable shall not be used for riser cables. Cable installed in environmental air spaces shall be plenum rated.
- B. Speaker Cable: Speaker cable shall be twisted pair with overall shield and jacket. Increase conductor size in speaker cable above #18 AWG as required to limit voltage drop to 5% at farthest speaker.

### 2.3 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers shall be as listed above, and as follows.
  - 1. Volume Controls: Soundolier, Switchcraft.
  - 2. Speakers: Altec-Lansing, Electro-Voice, Radian, Rauland-Berg, Soundolier.
  - 3. Speaker Enclosures: Lowell, Soundolier.
  - 4. Cable: West Penn, Belden, Canare.
- B. Substitutions may be considered only when submitted in conformance with Section 260100.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prior to beginning rough-in or ordering equipment for the paging system, arrange a pre-installation meeting on the site between all parties involved in the paging system installation, including the Paging System Installer and the Owner's representative. All parties shall review the paging system shop drawings, the manufacturer's installation

instructions, system interface requirements, applicable regulations and any site conditions pertinent to installation of the paging system.

1. Prepare minutes of the pre-installation meeting and distribute them to all parties in attendance at the meeting, and to the Owner's Representative and the Architect.

### 3.2 INSTALLATION

- A. Install the paging systems in accordance with the manufacturer's recommendations. Locate equipment and devices as indicated.
- B. Final connections between the equipment and the wiring system shall be made under the supervision of a representative of the system manufacturer.
- C. Cables shall be installed in metallic raceways or shall be plenum rated.
- D. Terminations shall be made in a neat and workmanlike manner. All terminations, controls and outlets shall be clearly and logically labeled in accordance with the requirements in Section 260553.
- E. Provide equipment identification in accordance with Section 260553.

### 3.3 MOUNTING HEIGHTS

- A. Mounting heights shall be as indicated on the Drawings.
- B. Speakers shall be installed flush in the center of ceiling tiles.

### 3.4 ADJUSTMENT, TESTING & DEMONSTRATION

- A. Adjust transformer tap settings for appropriate sound levels as directed by the Owner.
- B. After the complete system has been tested and is operating properly, the manufacturer's representative shall demonstrate by actual usage, the proper operation of each control device and system function in the presence of the Owner's Representative. Demonstration shall include repetition of selected field tests, as well as additional adjustment or testing required to demonstrate that the system performs in accordance with the operational description as specified herein and the Owner's operational requirements.

END OF SECTION 275113



## SECTION 281313 – ACCESS CONTROL SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work specified in this section.
- B. Related Sections:
  - 1. Division 8 – Hardware: Door hardware for interface with access control
  - 2. Section 260531 – Outlet Boxes: Outlet boxes for certain devices
  - 3. Section 260533 – Raceways: Raceway requirements

#### 1.2 SUMMARY

- A. Provide outlet boxes and a partial raceway system for access control devices and wiring to be provided by the Owner under a separate contract.
- B. The Owner will arrange for its Security System Installer to install the security system devices and wiring to provide access control for the doors indicated on the Drawings.
- C. Provide raceway and outlet boxes to the extent indicated on the Drawings for use by the Security System Installer.
- D. Coordinate the work of the Security System Installer with the work specified in this Section to allow the Security System Installer to access the project at the appropriate times to accommodate the installation of the access control devices.
- E. Arrange a meeting with the Owner' Representative and the Security System Installer to discuss the access control system requirements. Install raceway and boxes that meet the requirements of the Security System Installer.

#### 1.3 SUBMITTALS

- A. None required.

### PART 2 - MATERIALS

#### 2.1 BOXES

- A. As specified in Section 26051.
- B. Size and location as required to accommodate wiring provided by the Security System Installer.

## 2.2 RACEWAYS

- A. As specified in Section 260533. Raceway above accessible ceiling shall be EMT. Exposed raceway below ceiling shall be surface metallic raceway.
- B. Size as required to accommodate wiring provided by the Security System Installer.
- C. Surface metallic raceway shall be painted to match the wall surface or door frame on which it is installed.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prior to beginning rough-in for the access control system, arrange a pre-installation meeting on the site between all parties involved in the access control system installation, including the Security System Installer, the Electrical Systems Installer and the Owner's Representative. All parties shall review the access control system shop drawings, the manufacturer's installation instructions, system interface requirements, applicable regulations and any site conditions pertinent to installation of the access control system. Verify placement of motion detectors and installation criteria.
- B. Prepare minutes of the pre-installation meeting and distribute them to all parties in attendance at the meeting, and to the Owner's Representative and the Architect.

### 3.2 INSTALLATION

- A. Install raceway and boxes as indicated on the access control system shop drawings and as required by the Security System Installer.

### 3.3 MOUNTING HEIGHTS

- A. Locate boxes as heights as directed by the Security System Installer.

END OF SECTION 281313

## SECTION 283113 – FIRE DETECTION & ALARM SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work specified in this section.
- B. Related Sections:
  - 1. Section 260526 – Grounding & Bonding: Bonding requirements
  - 2. Section 260529 – Hangers & Supports: Support requirements
  - 3. Section 260531 – Outlet Boxes: Outlet boxes for certain devices
  - 4. Section 260533 – Raceways: Raceway requirements
  - 5. Section 262716 – Electrical Cabinet Enclosures: Cabinet requirements
  - 6. Section 280100 – Electronic Safety System Requirements: Product substitution procedures
  - 7. Section 280553 – Identification For Electronic Safety Systems: Identification requirements

#### 1.2 SUMMARY

- A. Extend the existing fire alarm and detection system as indicated on the Drawings.
- B. Provide new firmware, software and power supplies to enable the existing fire alarm control panel to operate the new fire alarm devices.
- C. The existing fire alarm control panel was manufactured by Simplex. All new equipment shall be of the same manufacturer as the existing equipment.
- D. Program the fire alarm system in accordance with requirements of the Authority Having Jurisdiction (AHJ) and directions received from the Owner's Representative.
- E. Adjust and test the fire alarm system, and demonstrate operation to the AHJ, and the Owner's Representative.

#### 1.3 GENERAL DESCRIPTION

- A. The system shall consist of control cabinets with system modules, relays, battery backup, annunciators and control switches, appliance extender panels, remote annunciators, remote control panels, manual stations, heat detectors, smoke detectors, audible and visual alarm signals, exterior bell, control relays, central station communicator and all other miscellaneous equipment required for a complete operable system which complies with all applicable codes and standards.
- B. The system components and system installation shall comply with NFPA 72, the City of Spokane Municipal Code and the International Fire Code.

- C. The entire system shall fully comply with all fire codes currently enforced at the project location. If any conflict occurs between the codes and these contract documents, the code shall govern. This does not relieve the Contractor of complying with any requirements of the plans and specifications which are in excess of the codes.
- D. The existing operating functions shall remain. All new devices shall operate similar to the existing devices of the same type.
- E. O&M manuals shall contain all information recommended by NFPA 72 Annex A.

#### 1.4 QUALIFICATIONS OF SYSTEM VENDER

- A. The System Vender shall be a factory-authorized dealer/distributor for the fire alarm system equipment manufacturer, with the capability of offering factory-certified service at the Project site, both during and after the warranty period.

#### 1.5 QUALIFICATIONS OF SYSTEM INSTALLER

- A. The System Installer shall be a factory-authorized installer for the fire alarm system equipment manufacturer.

#### 1.6 SUBMITTALS

- A. Product Data: For each type of equipment, initiating device, signal device, peripheral device and cable provided on the Project.
- B. Shop Drawings: Battery calculations, volt-drop calculations, tap settings, floor plans, wiring diagrams (including conductor size and type), an operational matrix and information (including address and telephone number) regarding the agency receiving off-premises transmission of alarms.
  - 1. In addition to submitting the shop drawings to the Architect for review, the same information shall also be submitted to each code-enforcing authority as required to obtain approval. Pay all review, permit and inspection fees required for approval of the fire alarm system work.
- C. Meeting Minutes: For pre-installation meeting.
- D. Test Reports: Record of all field test data.
- E. Meeting Minutes: For pre-installation meeting.

#### 1.7 INFORMATION FOR OPERATING & MAINTENANCE MANUALS

- A. Submittals: Information submitted for review, up-dated to record any changes.
- B. Operating Instructions: Supply a detailed narrative description of the system operation. Indicate expansion capability, application conditions and limitations of use. Include manufacturer's installation, operating and programming instructions.

- C. Maintenance Instructions: List replacement parts, including source. Indicate recommended and required maintenance and testing procedures and intervals. List all individual system components requiring periodic maintenance. Detail trouble-shooting procedures, including step-by-step instructions for all trouble signals annunciated by the system. Include a service directory with names and telephone numbers for use in obtaining service.
- D. Completion Certificate: Record of Completion in completed form.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- A. Control Panel: The existing control panel shall remain and shall be modified as necessary to accommodate the addition devices indicated on the Drawings.
- B. Notification Panel: Provide a new notification alarm control panel to provide audible and visual power circuits for new signal devices. Panel shall have integral charger and battery for emergency power.

### 2.2 INITIATION DEVICES

- A. Heat Detectors: Analog addressable dual-element type. Each detector shall include a fixed temperature element and a rate-of-rise element. Fixed temperature element shall be set at 57°C (135°F), except where a 94°C (200°F) element is specifically indicated. Rate-of-rise element shall be set at 9°C (15°F) per minute. Finish shall be white.
- B. Smoke Detectors: Analog, addressable photoelectric type. Finish shall be white.

### 2.3 ADDRESSABLE MODULES

- A. Monitor Modules: Addressable module for monitoring peripheral non-addressable initiating devices, such as water-flow switches and supervisory tamper switches. Provide sufficient addressable monitor modules to provide addresses for all normally-open (NO) contact-initiating devices.
- B. Control Modules: Output modules for connection to the same addressable loop as the addressable monitor devices. Control modules shall provide a Form C contact, rated 2-amps at 120 VAC. Provide control modules where necessary to provide a relay output for releasing door holder circuits, shutting down fans, and similar control functions.
- C. Signal Modules: Output modules for connection to the same addressable loop as the addressable monitor devices. Signal modules shall provide a Form C contact, rated 2 amps at 120 VAC. Provide signal modules where necessary to provide a Style Y supervised notification circuit.

### 2.4 SIGNAL DEVICES

- A. General: Alarm signals shall comply with UL 464, UL 1971, UL 1638, and the Americans with Disabilities Act (ADA). Audible signals shall sound in accordance with a

Code 3 temporal pattern. Strobes shall have a flash rate of 1 hertz. Wherever more than one visual signal is visible from any one location, all visual signals shall be self-synchronized. The strobe intensity shall be 15 candela minimum, with a near-axis intensity exceeding 75 candela. Where so indicated and where required to comply with the afore-mentioned standards, increased minimum strobe intensities shall be provided.

- B. Interior Audible/Visual Alarm Signals: Audible signals shall be horns that shall provide a selectable sound level consisting of at least two levels separated by a minimum of 4 dB within the range of 89 to 99 dBA, as measured at a distance of 3 m (10 ft) from the horn on axis. Visual signals shall have xenon strobes behind protruding clear lenses with the word "FIRE" in red letters on two sides. Audible and visual signals shall have a common faceplate, and shall be designed to be mounted on a common flush-mounted backbox. Finish shall be white.
- C. Interior Visual Alarm Signals: Xenon strobes behind protruding clear lenses with the word "FIRE" in red letters on two sides. Visual signals shall be designed to mount on a flush-mounted backbox, and shall match the audible/visual signals in appearance. Finish shall be white.

## 2.5 WIRE AND CABLE

- A. General: Wire size shall be minimum #14 AWG, except communications cable. Power and grounding conductors shall be minimum #12 AWG. All wire and cable shall be suitable for Fire Protective Signaling Circuit use. Minimum insulation rating shall be 300-VAC. Cable shall be rated FPL, FPLR or FPLP. FPL cable shall not be used for riser circuits. Cable installed in environmental air spaces shall be plenum rated.
- B. Addressable Loop Cable: Shielded #18 AWG twisted-pair cable with drain wire and over-all jacket.

## 2.6 ACCEPTABLE MANUFACTURERS

- A. New equipment shall be of the same manufacture as the existing equipment.
- B. No substitutions will be allowed.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Immediately upon notification of contract award, schedule a test of the existing fire alarm system to determine exactly which devices are connected to each existing circuit. During the testing, verify which circuits enter the existing fire alarm control panel in the same raceway. The information collected shall be used in preparing the shop drawings for the fire alarm system and in planning the sequence of work, with the goal of minimizing the system down-time required to replace circuitry in existing raceways.
- B. Prior to beginning installation of the fire alarm system, arrange a pre-installation meeting on the site between all parties involved in the fire alarm system installation, including the Fire Alarm System Vendor, the Fire Alarm System Installer, the Electrical Systems

Installer, and the Owner's Representative. All parties shall review the fire alarm system shop drawings, the manufacturer's installation instructions, applicable codes and standards, the requirements of the local AHJ and any site conditions pertinent to installation of the fire alarm system. It is suggested that the meeting occur prior to rough-in for the fire alarm system.

- C. Prepare minutes of the pre-installation meeting and distribute them to all parties in attendance at the meeting, and to the Owner's Representative and the Architect.

### 3.2 INSTALLATION

- A. Installation shall conform to the wiring diagrams submitted as shop drawings and to the manufacturer's instructions, recommendations and precautions.
- B. Installation of equipment, devices, wire and cable terminations, programming, adjusting, testing and demonstration shall be performed by an installer qualified to perform fire alarm system work, as specified herein.
- C. Final connections between the wiring system and the equipment shall be made under the supervision of a representative of the equipment manufacturer. Equipment shall not be energized until all connections have been approved by said representative.
- D. Fire alarm equipment and devices shall be protected from dust during construction. Smoke detector heads shall be installed only after dust-producing activities have completely ceased, building surfaces have been finished and clean-up by all trades has been completed. The plastic covers shipped with the detectors are for protection during shipping and storage, and are not suitable to protect detectors from construction dust.
- E. Provide backboxes matched to the device or equipment. Where manufacturer's installation instructions indicate use of standard outlet boxes, boxes shall be in accordance with Section 260531. Install plumb and aligned with building elements.
- F. Equipment and wiring terminals shall be installed in suitable enclosures. Where manufacturer does not offer suitable matched enclosures, install such equipment and wiring terminals in cabinets sized to accommodate the items enclosed, in accordance with Section 262716.
- G. Attach cabinets, enclosures and backboxes securely to the building structure in accordance with Section 260529.
- H. All wiring shall be installed in a metallic raceway system arranged as shown on the shop drawings. The raceway arrangement shown on the Contract Drawings is illustrative only, and shall not relieve the Contractor from responsibility to provide separate raceway for wiring connected to different class power supplies in accordance with NEC Article 760. Raceways shall conform to the requirements of Section 260533, and shall be bonded to the power system ground.
- I. Maintain consistent color-coding of conductors throughout the project. Wiring in cabinets and terminal boxes shall be neatly arranged and bundled with nylon wire ties.

- J. Locate ceiling-mounted smoke detectors at least 1219 mm (48 in) from supply air diffusers, and at least 900 mm (36 in) from return air grilles. Smoke detectors intended for door release shall be located on the ceiling not more than 1524 mm (60 in) away from the door.
- K. The specified alarm signals and their placement on the drawings are intended to be appropriate to achieve the required level of audibility and visibility. It shall be the responsibility of the System Vender to assure himself that the design is adequate per applicable codes. If additional signals are required to meet code standards they shall be provided at no additional cost to the Owner.
- L. In each cable that terminates at an outlet or device, provide 305 mm (12 in) of slack cable, neatly coiled, to facilitate future modifications.
- M. Terminations shall be made in a neat and workmanlike manner.
- N. All terminations, controls and outlets shall be clearly and logically labeled in accordance with the requirements in Section 280553.
- O. Provide bonding connections in accordance with Section 260526 and manufacturer's installation instructions.
- P. Provide raceway, back boxes, wiring, and power circuits for the fire alarm system, and install the devices ready for final termination at the Fire Alarm Panel by the Fire Alarm System Installer. Contact the Fire Alarm System Vendor prior to bidding to determine exact requirements and include all costs in the bid price.
- Q. Schedule periodic inspections by the AHJ during the course of the installation and shall make any minor corrections, deletions, relocations, or additions to the system as required for acceptance of the completed system by the AHJ. Contractor shall obtain and pay for all required permits.

### 3.3 PROGRAMMING

- A. The fire alarm system shall be reprogrammed to accommodate new devices. Programming shall comply with requirements of the AHJ and with direction received from the Owner's Representative.
- B. Programming shall be performed by an authorized manufacturer's representative.

### 3.4 ADJUSTMENT, TESTING & DEMONSTRATION

- A. Notify the Architect's Consultant, the Owner's Representative at least two (2) weeks in advance of the date of each test, to allow witnessing of the tests.
- B. Supply tools, instruments, gauges, testing equipment, protective devices, and safety equipment for adjustment, testing, and demonstration.
- C. During adjustment and testing, carefully record all settings and all test results, including expected test results, actual test results, and corrective actions taken. Records shall be



- submitted to the Architect's Consultant and included in the Operating & Maintenance Manuals.
- D. Test all fire alarm system wire and cable after installation and prior to connection to equipment. Tests to be performed shall include, but not be limited to, the following:
    - 1. Conductor continuity
    - 2. D.C. insulation resistance
    - 3. Freedom from shorts and grounds
  - E. Adjust taps on audible signal devices to produce a minimum sound level 15 dBA above the expected average ambient room sound level when the room is occupied and 5 dBA above the expected peak ambient sound level.
  - F. Prior to system testing, prepare a list of the devices to be tested, together with the associated location of each device, and the address of each initiating device. Note peripheral devices that are actuated by each initiating device, for verification. Include space to indicate test response for each device.
  - G. Test all system features for proper function. Tests shall be conducted by a manufacturer's representative after the system has been connected to the central monitoring agency. Notify the central monitoring agency prior to the tests. Tests to be performed shall include, but not be limited to, the following:
    - 1. Simulate alarm, supervisory and trouble conditions and verify proper annunciation.
  - H. Correct any deficiencies discovered as a result of the above testing, and completely retest the work affected by such corrections, with no additional compensation.
  - I. After the system has been completed, tested and is operating properly, the manufacturer's representative shall demonstrate by actual usage, the proper operation of each fire alarm device and function in the presence of the Authority Having Jurisdiction (AHJ) as required to obtain approval of the system. Demonstration shall include repetition of selected field tests, as well as additional adjustment or testing required to demonstrate that the system performs in accordance with applicable codes and standards and requirements of the Authority Having Jurisdiction. Any additional programming required by the AHJ shall also be performed by the manufacturer's representative, with no additional compensation.

### 3.5 RECORD OF COMPLETION

- A. Certify completion of the fire alarm system installation and testing in accordance with the plans approved by the AHJ, the manufacturer's instructions and applicable codes and standards. Written certification shall be submitted to the AHJ at completion of each phase of the work in accordance with NFPA 72, Article 1-7.2. Once final approval of the entire fire alarm system is obtained from the AHJ, the original copy of all Record of Completion certificates, together with the requisite Inspection and Testing Forms, shall be delivered to the Owner's Representative and photocopies shall be included in the Operating and Maintenance Manuals.

END OF SECTION 283113