# SPECIFICATIONS

# REPAIR GAS HEAT, B6604
## BARKSDALE AFB, LOUISIANA

## AWUB 10-0192

**PROJECT ASSOCIATES:**

**CIVIL ENGINEERS**
**S. E. HUEY CO.**
1111 N. 19TH ST.
MONROE, LA 71201
(318) 325-1791
www.sehuey.com

**MECHANICAL/ELECTRICAL ENGINEERS**
**JOHN J. GUTH ASSOCIATES**
208 MILAM ST.
SHREVEPORT, LA 71101
(318) 221-8638

**18 APR 17**

# REPAIR GAS HEAT, B6604
# BARKSDALE AFB
# AWUB 10-0192

TABLE OF CONTENTS

Specifications:

SECTION 01010 - SUMMARY OF THE WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROJECT/WORK IDENTIFICATION

A. General: Project name is "REPAIR GAS HEAT FAC #6604 – AWUB 10-0192" as shown on Contract Documents prepared by S. E. Huey Co. and John J. Guth Associates, Inc. Drawings and Specifications**.**

B. Summary by References: Work of the Contract can be summarized by references to the Contract, General Conditions, Supplementary Conditions, Specification Sections, Drawings, addenda and modifications to the Contract Documents issued as part of addenda subsequent to the initial printing of this project manual and including, but not necessarily limited to, printed material referenced by any of these. It is recognized that work of the Contract is also unavoidably affected or influenced by governing regulations, natural phenomenon, including weather conditions, and other forces outside the Contract Documents.

C. Abbreviated Written Summary: Briefly and without force and effect upon the contract documents, the work of the Contract can be summarized as follows:

1. Installation of radiant gas heaters in building 6604 (Hangar One) at Barksdale Air Force Base.

D. Utility Interruptions: Utility interruptions shall be held to a minimum and will be permitted only at times approved by the User Agency. The User Agency may require that any outages be during nights, weekends, or holidays. Provide any required overtime work at no additional cost to the Owner.

E. Shop Drawings

1. Contractor shall provide detailed AutoCAD shop drawings of all project work incorporating this statement of work and requirements of other project contract documents. Contractor shall provide thorough field investigation required for preparing the shop drawings.

2. Shop drawings which shall include detailed demolition and new work plans, hangar door and aperture repair plans, hangar door and aperture electrical plan and schematics, door and aperture operating control plans, schedules for motors, gearboxes, powertrain components, etc. and details of architectural, civil, structural, related to door repair project work.

3. Contractor shall not perform any construction work until all final shop drawings submittals are approved; submit per section 01400 and this section.

F. The Contractor shall be responsible for the printing costs for the reprinting of construction documents for their use.

G. The Contractor shall be responsible for meeting all applicable OSHA standards, including the Hazard Communication Standards.

H. Superintendent: Contractor is responsible for providing a full-time on-site superintendent for this project.

I. Completion Date: As required by Instructions to Bidders, the Contractor is required to fully complete construction of project within specified number of days. Contractor shall furnish sufficient forces, construction plant and equipment, and work such hours, including weekend and night shifts as may be necessary to insure prosecution of work in accordance with schedule to the contracted completion date. If, in the opinion of the Contracting Officer's Representative and Owner, Contractor falls behind progress schedule, Contractor shall take steps as may be necessary to improve his progress by such means as increasing number of men, number of shifts, days of work, and/or amount of construction plant, all without additional cost to Owner. If access to building is required at other than normal building hours, Contractor shall make arrangements with User Agency.

## 1.3 CONTRACTOR USE OF PREMISES

A. General: The Contractor shall limit his use of the premises to the work indicated, so as to allow for Owner occupancy with minimum interruptions. All access to building will require an escort, and therefore require making arrangements with user agency.

B. Use of the Site: Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction.

C. Keep existing driveways and entrances serving the premises clear and available to the Owner and his employees at all times. Do not use these areas for parking or storage of materials.

D. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas approved by User Agency. If additional storage is necessary, obtain and pay for such storage off-site. The Owner will not make payments for materials stored off-site.

E. Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.

F. Use of existing toilets within the buildings by the Contractor and his personnel will not be permitted.

G. General Requirements: Observe no smoking rules. All personnel must wear shirts. No radios or similar items may be used.

H. Asbestos: There is no asbestos abatement work included in this project. No asbestos-containing materials have been identified on items that are indicated to be disturbed. If asbestos-containing materials are encountered, please notify the Contracting Officer's Representative immediately.

1.4 OWNER OCCUPANCY

A. Full Owner Occupancy: The Owner will occupy the site during the entire period of construction. Cooperate fully with the Owner and his representative during construction operations to minimize conflicts and to facilitate Owner usage. Perform the work so as not to interfere with the Owner's operations. All access to building will require an escort, and therefore require making arrangements with user agency.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION (Not applicable)

END OF SECTION 01010

# SECTION 01045 - CUTTING AND PATCHING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the work.

1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 15 and Division 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

### 1.3 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform work.
4. Indicate dates when cutting and patching is to be performed.
5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
7. Approval by the Contracting Officer’s Representative to proceed with cutting and patching does not waive the Contracting Officer Representative's right to later require complete removal and replacement of a part of the work found to be unsatisfactory.

1.4 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.

1. Foundation construction.
2. Bearing and retaining wall.
3. Structural concrete.
4. Structural steel.
5. Lintels.
6. Timber and primary wood framing.
7. Structural decking.
8. Stair systems.
9. Miscellaneous structural metals.
10. Exterior curtain wall construction.
11. Equipment supports.
12. Piping, ductwork, vessels and equipment.
13. Structural systems of special construction in Division 11.

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

a. Shoring, bracing, and sheeting.
b. Primary operational systems and equipment.
c. Air or smoke barriers.
d. Water, moisture, or vapor barriers.
e. Membranes and flashings.
f. Fire protection systems.
g. Noise and vibration control elements and systems.
h. Control systems.
i. Communication systems.
j. Conveying systems.
k. Electrical wiring systems.
l. Special construction specified by Division 13 Sections.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent

surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

## PART 3 - EXECUTION

### 3.1 INSPECTION

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

1. Before proceeding, meet at the 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.

### 3.2 PREPARATION

A. Temporary Support: Provide temporary support of work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

### 3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
3. Comply with requirements of applicable Sections of Division 16 where cutting and patching requires excavating and backfilling.
4. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. 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.

## 3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely excess material, paint, mortar, oils, putty and items of similar nature.

END OF SECTION 01045

# SECTION 01090 - DEFINITIONS AND STANDARDS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including other Division 1 Specification sections, apply to work of this Section.

### 1.2 DESCRIPTION OF REQUIREMENTS

A. General: This section specifies procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the work. These requirements include obtaining permits, licenses, inspections, releases, and similar documentation, as well as payments, statements, and similar requirements associated with regulations, codes, and standards.

B. The term "Regulations" is defined to include laws, statutes, ordinances, and lawful orders issued by governing authorities, as well as those rules, conventions, and agreements within the construction industry which effectively control the performance of the work regardless of whether they are lawfully imposed by governing authority or not.

### 1.3 DEFINITIONS

A. General Explanation: Certain terms used in Contract Documents are defined in this Article. Definitions and explanations contained in this Section are not necessarily complete, but are general for the work to extent that they are not stated more explicitly in another element of the Contract Documents.

B. General Requirements: Provisions and requirements of other Division 1 Sections apply to the entire work of the Contract and, where so indicated, to other elements which are included in the project.

C. Indicated: The term "indicated" is a cross-reference to graphic representations, notes, or Schedules on the Drawings, to other paragraphs or schedules in the Specifications, and to similar means of recording requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader locate the cross-reference, and no limitation of location is intended except as specifically noted.

D. Directed, Requested, Etc.: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by the Contracting officer’s representative," "requested by the Contracting officer’s representative," and similar phrases. However, no such implied meaning will be interpreted to extend the Contracting officer’s representative's responsibility into the Contractor's area of construction supervision.

E. Approve: Where used in conjunction with the Contracting officer’s representative's response to submittals, requests, applications, inquiries, reports, and claims by the Contractor, the term

"approved" will be held to limitations of the Contracting officer's representative's responsibilities and duties. In no case will the Contracting officer's representative's approval be interpreted as a release of the Contractor from responsibilities to fulfill requirements of Contract Documents or acceptance of the work, unless otherwise provided by requirements of the Contract Documents.

F. Project Site: The term "project site" means the space available to the Contractor for performance of the work, either exclusively or in conjunction with others performing other construction 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 upon which the project is to be built.

G. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations."

H. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimensions, finishing, curing, protecting, cleaning, and similar operations."

I. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

J. Installer: The "installer" is "the entity" (person or firm) engaged by the Contractor, its subcontractor, or sub-subcontractor for performance of a particular element of construction at the project site, including installation, erection, application, and similar required operations. It is a requirement that installers are experienced in the operations they are engaged to perform.

K. Testing Laboratory: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests of the work, either at the project site or elsewhere, and to report and (if required) interpret results of those inspections or tests.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Except where more explicit or stringent requirements are written into the Contract Documents, applicable construction standards have the same force and effect as if bound into or copied directly into the contract documents. Such industry standards are made a part of the Contract Documents by reference. Individual specification sections indicate which codes and standards the Contractor must keep available at the project site for reference.

B. Referenced standards (standards referenced directly in the contract documents) take precedence over standards that are not referenced but generally recognized in the industry for applicability to the work.

C. Unreferenced Standards: Except as otherwise limited by the Contract Documents, standards not referenced but recognized in the construction industry as having direct applicability will be enforced for performance of the work. The decision as to whether an industry code or standard is applicable, or as to which of several standards are applicable, is the sole responsibility of the Contracting officer's representative.

D. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of Contract Documents.

E. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the contract documents specifically indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Contracting officer's representative for a decision before proceeding.

F. Minimum Quantities or Quality Levels: In every instance, the quantity or quality level shown or specified is intended to be the minimum to be provided or performed. Unless otherwise indicated, the actual work may either comply exactly, within specified tolerances, with the minimum quantity or quality specified, or may exceed that minimum within reasonable limits. In complying with these requirements, the indicated numeric values are minimum or maximum values, as noted, or as appropriate for the context of the requirements. Refer instances of uncertainty to the Contracting officer's representative for decision before proceeding.

G. Copies of Standards: The contract documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also required to be familiar with industry standards applicable to that part of the work. Copies of applicable standards are not bound with the contract documents.

H. Where copies of standards are needed for proper performance of the work, the Contractor is required to obtain such copies directly from the publication source.

I. Although copies of standards needed for enforcement of requirements may be required submittals, the Contracting officer's representative reserves the right to require the Contractor to submit additional copies as necessary for enforcement of requirements.

J. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where acronyms or abbreviations are used in Specifications or other Contract Documents they are defined to mean the recognized name of the trade association, standards generating organization, governing authority or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

1.5 SUBMITTALS

A. Permits, Licenses, and Certifications: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01090

# SECTION 01200 - PROJECT MEETINGS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 RELATED SECTIONS

A. Construction Schedule: Division 1 Section 01400, "Submittals."

### 1.3 PROGRESS MEETINGS

A. No regularly-scheduled progress meetings will occur during the construction period. Meetings will only be scheduled as necessary to address questions or problems related to the construction.

## PART 2 - PRODUCTS (NOT APPLICABLE)

## PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01200

# SECTION 01400 - SUBMITTALS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Closeout Submittals: Division 1 Section 01700, "Project Closeout."

### 1.3 CONSTRUCTION SCHEDULE

A. General: Contractor shall, within ten days after signing the Contract, prepare and submit to Contracting Officer’s Representative for information purposes, a practical schedule showing order in which Contractor proposes to carry on work, dates on which he will start salient features of work, and contemplated dates for completion. Schedule shall meet or better construction time included in Contract Documents.

B. Form of Schedule: Provide in form of horizontal bar chart. Provide separate horizontal bar column for each trade or operation. Order shall be Table of Contents from Project Manual or the chronological order of beginning of each item of work. Submit three copies to Contracting Officer’s Representative.

C. Content of Schedule: Provide complete sequence of construction activity, dates for beginning, and completion of each element of construction. Identify work of separate phases or other logically grouped activities. Show projected percentage of completion for each item of work as of first day of each month.

### 1.4 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. Shop Drawings:

1. Submit prints of original drawings prepared by Contractor, subcontractor, supplier, or distributor which illustrate same portion of work; showing fabrication, layout setting, or erection details.
2. For extensive modifications, prints may be returned to Contractor for correction. When reviewed, Contracting Officer’s Representative will retain two copies for record and return remaining copies to General Contractor for distribution. Reproducible copies of shop drawings will not be reviewed.

B. Product Data:

1. Manufacturer's Standard Drawings: Modify drawings to delete information which is not applicable to project. Supplement standard information to provide additional information applicable to project.

2. Manufacturer's Catalog Sheet, Brochures, Diagrams: Clearly mark each copy to identify pertinent materials, product, or models. Show dimensions and clearances required. Show performance characteristics and capacities.

C. Samples:

1. Physical examples to illustrate materials, equipment, or workmanship to establish standards by which completed work is judged.
2. Office samples shall be of sufficient size and quantity to clearly illustrate functional characteristics of product or material and full range of color and texture samples.

D. General Submission Requirements:

1. Quantities: Submit the number of copies of product data and shop drawings that the Contractor requires for distribution, plus two copies which will be retained by the Contracting Officer's Representative. Quantity of samples required shall be as specified in Specification Section for respective product.

E. Submittals shall include:

1. Project title.
2. Names of Contractor, Subcontractor, Supplier, Manufacturer.
3. Identification of Product.
4. Relation to adjacent structure or materials.
5. Field dimensions.
6. Reference to Engineer's drawing numbers, specification section, room numbers, structural framing marks, and/or numbers.
7. Applicable standards: e.g., ASTM.
8. Blank space for Engineer's stamp.
9. Identification of deviations from Contract Documents.
10. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements, and compliance with Contract Documents.

F. Return and Disapproval of Submittals:

This is a routine project. The Contracting Officer will return submittals made with AF Form 3000 to the Contractor within 14 days after receipt, using the AF Form 3000 to show approval or disapproval. Resubmit revisions of disapproved submittals within 14 days after receipt of disapproval, again using AF Form 3000. Disapproval shall not be cause for a time extension.

G. Submittal Register: Contractor is to use and adhere to Submittal Register provided at the end of this Section.

1.5 SCHEDULE OF VALUES

A. General: Submit to Owner a Schedule of Values at least ten days prior to submitting first Application for Payment. Upon request by Owner, support values with data that will substantiate their correctness. Use Schedule of Values only as basis for Contractor's Application for Payment. Itemize separate line item cost for work required by each section of this specification.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01400

# SCHEDULE OF MATERIAL SUBMITTALS
# BARKSDALE AFB

| PROJECT NO. | PROJECT TITLE | SOLICITATION/CONTRACT NO. |
|---|---|---|
| UHHZ159000 | RPR/ RPL HVAC system, B/221 | FA8501-XXXX |

**TO BE COMPLETED BY PROJECT ENGINEER**

| LINE NUMBER | ITEM OR DESCRIPTION OF ITEM, CONTRACT REFERENCE, TYPE OF SUBMITTAL | NO. OF COPIES REQUIRED: BEFORE CONSTR: SHOP DRAWINGS | SAMPLES | COLOR SELECTION | MANUFACTURER'S RECOMMENDATIONS | CATALOG DATA | OTHER MATERIAL OR DATA | AFTER CONSTR: CERTIFICATION OF COMPLIANCE AND CLOSEOUT | CLOSEOUT | MANUFACTURER'S WARRANTY | OPERATING INSTRUCTIONS | REQUIRED SUBMITTAL DATE | DATE RECEIVED IN CONTRACTING | DATE TO CIVIL ENGR. | RETURN SUSPENSE DATE | FOLLOW-UP | DATE CONTRACTOR NOTIFIED: APPROVED | DISAPPROVED | CONTRACTOR RESUBMITTAL | FINAL APPROVAL | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Shop Drawings Submittal | 4 | | | | | | | | | | NTP + 30 | | | | | | | | | |
| 2 | Equipment Material Submittals | | | | 4 | | | | | | | NTP + 21 | | | | | | | | | |
| 3 | Equipment Manufacturer's catalog cut sheets | | | | | 4 | | | | | | NTP + 21 | | | | | | | | | |
| 4 | Other Material Submittals<br>See applicable spec sections for all mat. submittals (constr.) | | | | 4 | | | | | | | NTP + 21 | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | |
| 6 | Corrected Final shop drawings Submittal | 4 | | | | | | | | | | NTP + 40 | | | | | | | | | |
| 7 | AF2519 Welding and Safety Checklist | | | | | | 4 | | | | | NTP + 21 | | | | | | | | | |
| 8 | Contractor's Kickoff Meeting Checklist | | | | | | 4 | | | | | At Kick-off Meeting | | | | | | | | | |
| 9 | Work Plan | | | | | | 4 | | | | | NTP + 21 | | | | | | | | | |
| 10 | Solid Waste Disposal Plan | | | | | | 4 | | | | | NTP + 21 | | | | | | | | | |
| 11 | Storage and Trailer Request | | | | | | 4 | | | | | NTP + 21 | | | | | | | | | |
| 12 | Time Schedule | | | | | | 4 | | | | | NTP + 21 | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | |
| 14 | AF Form 3064 & 3065 | | | | | | 2 | | | | | NTP + 21 | | | | | | | | | |
| 15 | List of Proposed Subcontractors | | | | | | 1 | | | | | NTP + 21 | | | | | | | | | |
| 16 | Superintendent & Certified Formen | | | | | | 1 | | | | | NTP + 21 | | | | | | | | | |
| 17 | Systems Functional Test Report | | | | | | | 4 | | | | 7 Days prior to Pre-Final Insp. | | | | | | | | | |
| 18 | Request for Final Inspection | | | | | | | 1 | | | | 7 Days prior to Pre-Final Insp. | | | | | | | | | |
| 19 | Operations and Maintenance Manuals | | | | | | | | | | 4 | Prior to Closeout | | | | | | | | | |
| 20 | As-built Drawings (for each project) | | | | | | | | | | 4 | Prior to Closeout | | | | | | | | | |
| 21 | Warranties | | | | | | | | | 1 | | Prior to Closeout | | | | | | | | | |
| 22 | Construction List of Material Submittals | | | | | | | | 1 | | | Prior to Closeout | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | | | | | | | | |

# SCHEDULE OF MATERIAL SUBMITTALS
# BARKSDALE AFB

| PROJECT NO. | PROJECT TITLE | SOLICITATION/CONTRACT NO. |
|---|---|---|
| UHHZ159000 | RPR/ RPL HVAC system, B/221 | FA8501-XXXX |

**TO BE COMPLETED BY PROJECT ENGINEER**

| LINE NUMBER | ITEM OR DESCRIPTION OF ITEM, CONTRACT REFERENCE, TYPE OF SUBMITTAL | NO. OF COPIES REQUIRED: BEFORE CONSTR: SHOP DRAWINGS | SAMPLES | COLOR SELECTION | MANUFACTURER'S RECOMMENDATIONS | CATALOG DATA | OTHER MATERIAL OR DATA | AFTER CONSTR: CERTIFICATION OF COMPLIANCE AND CLOSEOUT | CLOSEOUT | MANUFACTURER'S WARRANTY | OPERATING INSTRUCTIONS | REQUIRED SUBMITTAL DATE | DATE RECEIVED IN CONTRACTING | DATE TO CIVIL ENGR. | RETURN SUSPENSE DATE | FOLLOW-UP | DATE CONTRACTOR NOTIFIED: APPROVED | DISAPPROVED | CONTRACTOR RESUBMITTAL | FINAL APPROVAL | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | | | | | | | | | | | | | | | | | | | | | |
| 33 | | | | | | | | | | | | | | | | | | | | | |
| 34 | | | | | | | | | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | | | | | | | | |
| 36 | | | | | | | | | | | | | | | | | | | | | |
| 37 | | | | | | | | | | | | | | | | | | | | | |
| 38 | | | | | | | | | | | | | | | | | | | | | |
| 39 | | | | | | | | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | | | | | | | | |
| 41 | | | | | | | | | | | | | | | | | | | | | |
| 42 | | | | | | | | | | | | | | | | | | | | | |
| 43 | | | | | | | | | | | | | | | | | | | | | |
| 44 | | | | | | | | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | | | | | | | | |
| 46 | | | | | | | | | | | | | | | | | | | | | |
| 47 | | | | | | | | | | | | | | | | | | | | | |
| 48 | | | | | | | | | | | | | | | | | | | | | |
| 49 | | | | | | | | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | | | | | | | | |
| 51 | | | | | | | | | | | | | | | | | | | | | |
| 52 | | | | | | | | | | | | | | | | | | | | | |
| 53 | | | | | | | | | | | | | | | | | | | | | |
| 54 | | | | | | | | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | | | | | | | | |
| 56 | | | | | | | | | | | | | | | | | | | | | |
| 57 | | | | | | | | | | | | | | | | | | | | | |
| 58 | | | | | | | | | | | | | | | | | | | | | |
| 59 | | | | | | | | | | | | | | | | | | | | | |

NOTE: This Submittal Schedule is for the Contractor's use in assembling and organizing the Submittals to be made to the Government. See individual specification sections for possible additional submittal requirements.

LEGEND:
D-NTP = Design NTP, C-NTP = Construction NTP

# SECTION 01500 - TEMPORARY FACILITIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 BARRICADES AND LIGHTS

A. Where the work is constructed in or adjacent to any road, parking area, or public place, the Contractor shall, at his own cost and expense, furnish and erect such barricades, lights, and danger signals, and take such other precautionary measures for the protection of persons and property and of the work, as are necessary. At the completion of construction, all barricades and all traces thereof, shall be removed, holes filled, paving repaired, etc.

### 1.3 TEMPORARY LADDERS, SCAFFOLDS, HOISTS, ETC.

A. Contractor shall provide and maintain all equipment such as temporary ladders, ramps, scaffolds, hoists, runways, derricks, chutes, etc., as required for the proper execution of the work.

B. All such apparatus, equipment, and construction shall meet all requirements of the Labor Law and other Federal and State Laws applicable thereto.

C. Contractor shall provide, maintain, and remove at completion of work all scaffolding required for the execution of the work. Erect scaffolding on the side of the wall on which work occurs. No scaffolding shall be built into any work.

D. Scaffolding for all other work shall be provided, installed, maintained, and removed at completion of work by the trade requiring such scaffolding.

### 1.4 STORAGE OF MATERIALS

A. The contractor shall submit a written request with a drawing showing the proposed laydown area for approval through 2 CES leadership.

B. Contractor shall provide, on the premises where directed, suitable storage sheds (substantial and watertight) in which he shall store all materials subject to damage by weather. All storage sheds shall be of sufficient size to hold all materials required on the site at one time, and shall have floors raised at least 6" above the ground on heavy joists or sleepers. Storage sheds shall have neat appearance.

C. Major subcontractors shall provide such temporary buildings as, in the opinion of the Contracting Officer’s Representative, may be necessary to fully protect their materials,

equipment, apparatus, etc., during the progress of the work. Such buildings shall have neat appearance.

D. Building materials, Contractor's equipment, etc., shall be stored on the premises in a manner so that it may be observed at any time by the Contracting Officer's Representative.

E. All materials affected by the weather shall be covered and protected and kept free from damage while being transported to the site.

F. Subcontractors desiring to store materials scheduled for immediate use in the building may do so only in locations as directed by the General Contractor and approved by the Contracting Officer's Representative.

1.5 SANITARY FACILITIES

A. Provide single-occupant, self-contained toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar non-absorbent material. Contractor shall keep such place in sanitary condition and remove at completion of contract. Facility fixtures shall not be used by workmen. Comply with all applicable codes, utility, and safety regulations.

1.6 LAYING-OUT OF WORK

A. Contractor shall compare all drawings and verify all dimensions, and shall take any and all measurements necessary to verify the drawing dimensions in relation to conditions already established at the job site before laying out the work. Contractor will be held responsible for subsequent errors which could have been avoided by such checking.

B. Any discrepancy which will affect the proper layout of the work shall be immediately called to the attention of the Contracting Officer's Representative by the Contractor. No work shall proceed until such discrepancy has been rectified as directed by the Contracting Officer's Representative.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01500

# SECTION 01600 - MATERIAL AND EQUIPMENT

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. The general provisions of the Contract apply to the work specified in this Section. Refer to other Division 1 Sections for additional requirements which may affect the work of this Section.

### 1.2 RELATED REQUIREMENTS

### 1.3 GENERAL PRODUCT REQUIREMENTS

A. Provide products, materials, and equipment which comply with the requirements and which are undamaged and unused at the time of installation, and which are complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and for the intended use and effect. Do not use material or equipment for any purpose other than that for which it is designed or specified.

### 1.4 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Contracting Officer’s Representative. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition, and adjust product in strict accord with such instructions and in conformity with specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Contracting Officer’s Representative for further instructions. Do not proceed with work without clear instructions.

C. Perform work in accord with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

### 1.5 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by method to prevent soiling or damage to products or packaging.

### 1.6 STORAGE AND PROTECTION

A. Store products in accord with manufacturer's instructions, with seals and labels intact and legible. Store products subject to damage by the elements in weathertight enclosures. Maintain temperature and humidity within the ranges required by manufacturer's instructions. Provide fence with obscuring fabric to encircle all site-stored material.

B. Exterior Storage: Store fabricated products above the ground, on blocking or skids, prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

D. Protection After Installation: Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01600

# SECTION 01700 - PROJECT CLOSEOUT

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 DESCRIPTION OF REQUIREMENTS

A. Definitions: Project closeout is the term used to describe certain collective project requirements, indicating completion of the work that is to be fulfilled near the end of the contract time in preparation for final acceptance and occupancy of the work by the Owner, as well as final payment to the Contractor and the normal termination of the Contract.

B. Specific requirements for individual units of work are included in the appropriate Sections in Division 2 through 16.

### 1.3 CLOSEOUT SUBMITTALS

A. Submit to Contracting Officer’s Representative for review, four copies each of the following items and other items as specified. Approved copies will be transmitted to Owner by Contracting Officer’s Representative.

B. Operation and Maintenance Data: Refer to Article titled "Operation and Maintenance Manuals" hereinafter this Section.

C. Record Drawings: Refer to "Record Drawings" article hereinafter this section (one copy required).

D. Release of Liens.

E. Consent of Surety to Final Payment.

### 1.4 OPERATION AND MAINTENANCE MANUALS

A. Purpose: Operation and maintenance manuals will be used for training of, and use by, the Owner and his employees in the operation and maintenance of the systems and related equipment as specified below. A separate manual or chapter shall be prepared for instructions of each class of equipment or system.

B. Contents: Manuals shall contain the following information on each item of equipment:

1. Routine maintenance operations.
2. Complete operating instructions.
3. Service instructions.

4. Complete control wiring.
5. Emergency procedure.
6. Equipment warranties or guarantees.

C. Preparation: The manuals shall be prepared to provide for the optimum operation and maintenance of the various systems outlined above and equipment forming a part of these systems. Manufacturer's literature and data shall be that of the actual equipment installed under contract for the particular facility. Each manual containing the systems noted shall be bound in one or more volumes as required for convenience in handling. In addition to "hard" (paper) copy manuals, provide "electronic files" on CD or DVD in Microsoft® Office or Adobe Acrobat.

D. Quantity: Provide 3 sets of O&M Manuals in D-type, 3 ring binders.

1.5 INSTRUCTIONS

A. Instruct Owner's personnel in operation of all systems, mechanical, electrical, and other equipment in accordance with respective Specification Sections and manufacturer's instructions.

1.6 RECORD DRAWINGS

A. Mark-Up Procedure: During progress of work, maintain a white-print set of Contract Drawings and shop drawings, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whatever drawing is most capable of showing actual physical condition, fully and accurately. Where shop drawings are marked up, cross-reference on contract drawings at corresponding location. Mark with erasable colored pencil, using separate colors where feasible to distinguish between changes for different categories of work at same general location. Mark-up important additional information which was either shown schematically or omitted from original drawings. Give particular attention to information on work concealed, which would be difficult to identify or measure and record at a later date. Note alternate numbers, change order numbers, and similar identification.

B. Submittal: Contractor shall provide as-builts to incorporate all mark-ups to include: one full size hardcopy set on paper; one CD-ROM disk with all drawings sheets in PDF and AutoCAD v2012 (v2009 is acceptable) format. CAD drawings shall have “Bind” command run such that each sheet can stand alone without references or attachments

1.7 CLEANING UP

A. No rubbish shall be allowed to accumulate or be allowed to remain on the premises or job site beyond a reasonable length of time. Trash shall be removed from within the building and from the site daily. Particular attention shall be given to these requirements.

B. All rubbish shall be removed by means of chutes, hoists, or receptacles. Under no circumstances shall any rubbish or waste be dropped or thrown from one level to another within or outside the buildings. Immediately after unpacking materials, all packing case lumber and other packing materials, excelsior, wrappings, and other like flammable wastes shall be collected and removed from the buildings and premises. Burning of trash on the site will not be permitted.

C. Care shall be taken by all workmen not to mark, soil, or otherwise deface any finishes. In the event that any finishes become defaced in any way by mechanics or workmen, the Contractor or any of his sub-contractors shall clean and restore such surfaces to their original condition.

D. Each subcontractor engaged upon the work shall bear his full responsibility for leaving all work in a clean and proper condition, satisfactory to the Owner and the Contracting Officer's Representative.

E. Final Cleaning: Beside the general broom cleaning, the following cleaning shall be done just before final acceptance of the work:

1. Remove all labels not intended for permanent installation.
2. Remove all marks, stains, fingerprints, and other soil or dirt from all painted work, and clean as required to leave in first class condition.
3. Clean all equipment removing all stains, paint, dirt, and dust.

F. Upon completion of the work, the Contractor will be required to thoroughly clean the building site and surrounding ground, and all trash and rubbish left by him in the course of construction of the work shall be removed and disposed of off the site of work.

G. Contractor shall haul off all debris from the site to legal disposal areas and dispose of all debris and excess materials resulting from project work. No burning of material or debris shall be done at site. In hauling material from the site, it shall be the responsibility of the Contractor to prevent debris from dropping from vehicles and littering the site and any public thoroughfare.

1.8 FINAL INSPECTION

A. Contractor shall submit written certification that:

1. Contract Documents have been reviewed.
2. Project has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents.
4. Equipment and systems have been tested in presence of Owner's Representative and are operational.
5. Project is completed, and ready for final inspection.

B. Contracting Officer's Representative will make final inspection after receipt of certification.

C. Should Contracting Officer's Representative consider that work is not finally complete, he will notify the Contracting Officer, in writing, stating reasons.

1.9 FINAL PAYMENT

A. Application for final payment shall be submitted together with documents specified in Section 1.3 of this specification.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01700

# SECTION 01710 - CLEANING

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. Work included: Throughout the construction period, maintain the buildings and site in a standard of cleanliness as described in this Section.

B. Related Work:

1. Documents affecting work of this section include, but are not necessarily limited to, Sections in Division 1 of these Specifications.
2. In addition to standards described in this Section, comply with requirements for cleaning as described in pertinent other Sections of these Specifications.

### 1.2 QUALITY ASSURANCE

A. Conduct daily inspection, and more often if necessary, to verify that requirements for cleanliness are being met.

## PART 2 - PRODUCTS

### 2.1 COMPATIBILITY

A. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

## PART 3 - EXECUTION

### 3.1 PROGRESS CLEANING

A. General:

1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
2. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
3. At least twice each month completely remove all scrap, debris, and waste material from the site.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Weekly, and more often if necessary, inspect all arrangements of

materials, restock if necessary.

C. Structures:

1. Weekly and more often in necessary, inspect the structures and remove all scrap, debris, and waste material.
2. Weekly, and more often if necessary, sweep interior spaces clean.
3. Following the installation of finished floor materials, clean the finish floor daily at all times while work is being performed.
4. Clean all surfaces, interior and exterior, and maintain a reasonably clean structure at all times.

END OF SECTION 01710

# SECTION 01732 - SELECTIVE DEMOLITION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of a building or structure.
2. Repair procedures for selective demolition operations.

B. Related Sections include the following:

1. Division 1 Section 01010, "Summary of Work," for use of the premises and phasing requirements.
2. Division 1 Section 01500, "Temporary Facilities," for temporary construction and environmental-protection measures for selective demolition operations.
3. Division 1 Section 01045, "Cutting and Patching," for cutting and patching procedures for selective demolition operations.

### 1.3 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.

### 1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

1.6 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for condition of areas to be selectively demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site will not be permitted.

F. Utility Service: Maintain existing utilities on roof in service unless indicated to be removed and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

G. Notify Contracting Officer’s Representative of discrepancies between existing conditions and drawings before proceeding with selective demolition.

1.7 WARRANTY

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

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of any items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Contracting Officer’s Representative.

3.2 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
3. Protect existing site improvements, appurtenances, and landscaping to remain.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.

## 3.4 POLLUTION CONTROLS

A. Dust Control: Use temporary enclosures and other suitable methods to limit spread of dust and dirt.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions.
2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

## 3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining

construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations. Hot work permit required from Base CE/Fire Department prior to this work.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.
10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing Facilities: Comply with building manager's requirements for using and protecting building facilities during selective demolition operations.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Contracting Officer’s Representative, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

## 3.6 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching: Comply with Division 1 Section 01045, "Cutting and Patching."

C. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

E. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

## 3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 01732

# SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Sleeves.
4. Escutcheons.
5. Mechanical demolition.
6. Equipment installation requirements common to equipment sections.
7. Painting and finishing.
8. Concrete bases.
9. Supports and anchorages.
10. Motor starters.

### 1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Except as otherwise defined in greater detail, the term "provide" means furnish and install, complete in every respect and ready for the intended use, as applicable in each instance.

I. Wiring: the term "wiring" shall include providing raceway, conductors, and cable in accordance with the requirements of Division 16.

J. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

K. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

## 1.4 SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.

B. Coordination Drawings: Submit, as soon as feasible after award of contract, equipment room and exterior equipment layouts at a scale not less than 1/4 inch = 1 foot showing the layout of the actual equipment to be used. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the work.

## 1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

C. Equipment Selection: Equipment of higher electrical characteristics, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are appropriately modified. The Contractor will be responsible for any added costs for

such modifications. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

D. Drawings: The Mechanical drawings show the general arrangement of piping, equipment, and appurtenances, and shall be followed as closely as actual building construction and the work of other trades will permit. The Mechanical work shall conform to the requirements shown on all the drawings. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. The Contractor shall investigate the structural and finish conditions and other building components affecting the work and shall arrange his work accordingly, providing such offsets, fittings, and accessories as may be required to meet such conditions. No extras will be approved for required additional offsets and fittings. Any offsets or additional fittings required to coordinate mechanical systems with existing conditions and other trades, or that are necessary for the complete installation of the system, including modifications to shop or off-site fabricated piping and/or ductwork, all shall be provided by the Contractor at no additional cost to the Owner.

E. Codes and Standards: comply with the following codes. Comply with the latest edition except where indicated otherwise or a specific edition is required by the authority having jurisdiction:

1. International Building Code.
2. International Mechanical Code.
3. International Plumbing Code.
4. NFPA 54, 70, and 101.
5. All applicable local codes.

## 1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

## 1.7 COORDINATION

A. Coordinate mechanical equipment installation with other building components and existing conditions.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and other concealment.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by firms regularly engaged in the manufacture of products required, whose products have been in satisfactory use in similar service.

### 2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 Piping Sections and "Pipe and Fitting Material Schedule" on the Drawings for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

A. Refer to individual Division 15 Piping Sections and "Pipe and Fitting Material Schedule" on the Drawings for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8 inch (3.2 mm) maximum thickness unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BAg1, silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

## 2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, flanged, solder-joint, plain, or weld-neck end connections that match piping system materials and isolate joined dissimilar metals to prevent galvanic action and stop corrosion.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300 psig (2070 kPa) minimum working pressure at 225 degrees F (107 degrees C).

## 2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239 inch (0.6 mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

## 2.6 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. Split-Plate, Stamped-Steel Type: With concealed hinge, spring clips, and chrome-plated finish.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000 psi (34.5 MPa), 28 day compressive strength.
3. Packaging: Premixed and factory packaged.

2.8 MOTOR STARTERS

A. Square D TeSys D-Line, General Electric CR300-Line, or approved equivalent (except where reduced voltage type are specified) with overload protection in each phase (with correctly sized heaters) in NEMA Type I enclosure unless noted otherwise, reset button in cover, and all of the same manufacturer. Provide auxiliary contacts for interlocking where required. Coordinate auxiliary contact needs with Division 15 Section 15971, "Building Management and Control Systems." Include HOA switch and pilot light in cover. Provide control power step-down transformer with sufficient additional capacity to handle essential control requirements (coordinate with Division 15 Section 15971, "Building Management and Control Systems").

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

A. Disconnect, demolish, and remove mechanical 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. Equipment to Be Removed: Disconnect and cap services and remove equipment.
3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
4. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

B. If pipe, to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Install components with pressure rating equal to or greater than system operating pressure.

C. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

D. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

E. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

F. Install couplings according to manufacturer's written instructions.

G. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

H. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

I. Install all buried water piping, regardless of content, a minimum of 12 inches below and 12 inches laterally from any buried electrical line. Whether in conduit or direct buried cable, this requirement shall apply regardless of voltage of the electrical line.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

K. Install piping to permit valve servicing.

L. Install piping at indicated slopes.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Pulled-tee, extruded-tee, thread-o-let, weld-o-let, and mitered elbow connections are not acceptable unless specifically indicated otherwise. Provide manufactured tee and elbow fittings.

P. Install tees with removable threaded cleanout plugs at each change in direction in all condensate drain piping.

Q. Select system components with pressure rating equal to or greater than system operating pressure.

R. 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: Cast-brass type with chrome-plated finish, split-casing for existing piping, and one-piece for new piping.

c. Insulated and Bare Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
d. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

S. Sleeves are not required for core-drilled holes in masonry or concrete walls.

T. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

U. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4 inch (6.4 mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating interior walls.

3. Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.

V. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1 inch (25 mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.

W. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

X. Verify final equipment locations for roughing-in.

Y. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

## 3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements, Division 15 Sections, and Schedules on the Drawings, specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

## 3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

## 3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Manufacturer's Installation and Operating Instructions: All equipment and material shall be installed and operated in strict accord with manufacturer's "Installation and Operating Instructions." The manufacturer's installation instructions shall become part of this Specification, and shall take precedence over and/or supplement any Specification herein and as shown and/or described on Plans. All individual items of equipment and components thereof shall be 100 percent accessible for repair, removal, or replacement without functional impairment or dismantling of any adjoining major surfaces or assemblies.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment to allow right of way for piping installed at required slope.

F. Cut and drill floors, roofs, walls, partitions, ceilings, and other surfaces as required to permit installation of mechanical piping, ducts, and equipment. Perform cutting by skilled mechanics of trades involved. 24-hour notice to Owner must be given before hammer drilling, coring, etc. (noise) to owner.

G. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

H. Electrical Work: Wherever equipment requiring electrical power connection is specified, all wiring shall be furnished and installed under Division 16 of the Specifications. Motor starters, starting switches, protective devices, and other means for the operation and control of equipment shall be furnished under the various Division 15 Sections, and installed and electrically connected complete under Division 16 unless otherwise specifically noted, except that control devices that are installed in or on ducts, piping, or mechanical equipment shall be mounted under Division 15. If equipment is furnished requiring power wiring different

from that indicated on the electrical drawings, the Contractor furnishing the equipment shall be responsible for any required revisions and pay any additional costs connected therewith. Wiring revisions shall be submitted to the Architect for approval prior to installation.

1. Motor starters shall be provided for each poly phase motor and for single phase motors requiring automatic control. See motor control center schedule on electrical drawings for starters that will be provided under Division 16. Additional disconnects required by the National Electrical Code shall be furnished, installed, and connected under Division 16 of the Specifications.
2. Contractors furnishing items to be wired shall provide adequate wiring diagrams.
3. Temperature control wiring shall be furnished and installed in raceway under Division 15 according to the requirements of Division 16, specifically Section 16120, "Conductors and Cables," and Section 16130, "Raceways and Boxes."

## 3.6 PAINTING

A. Touching Up: Provide cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

## 3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases 8 inches thick, of dimensions indicated, but not less than 6 inches (100 mm) larger in both directions than supported unit.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
4. Use 3000 psi (20.7 MPa), 28 day compressive-strength concrete and reinforcement as follows:

    a. Reinforcing bars: ASTM A 615/A 615M, Grade 60; deformed.
    b. Number 5 bars, top and bottom at 12 inches o.c. each way.

END OF SECTION 15050

# SECTION 15060 - HANGERS AND SUPPORTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

### 1.3 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."

### 1.4 SUBMITTALS

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

B. Welding Certificates: Copies of certificates for welding procedures and operators.

### 1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Firms regularly engaged in manufacture of supports and hangers, of types and sizes required, whose products have been in satisfactory use in similar service.

### 2.2 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. Nonmetallic Coatings: On hangers for electrolytic protection where hangers are in direct contact with copper tubing.

## 2.3 MISCELLANEOUS MATERIALS

A. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out 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

## 3.1 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. 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 (DN15 to DN750).

D. 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 (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 degrees F (49 to 232 degrees C) piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

E. Building Attachments: Except as otherwise indicated, provide factory-fabricated building attachments complying with ANSI/MSS SP-58, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods.

F. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.

H. Thermal-Hanger Shield Inserts:

1. Description: 100 psig (690 kPa) minimum, compressive-strength insulation insert encased in sheet metal shield.

2. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.
3. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.
4. For Hangers and Clamped Systems: Insert and shield shall cover entire circumference of pipe.
5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

## 3.2 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. All hangers for equipment and piping are to be supported from building structure even if structural enhancements to roof support is required.

B. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping.

C. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

E. 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.

F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," are not exceeded.

H. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

I. Support vertical piping at each floor and roof.

J. Insulated Piping: Comply with the following:

1. All hangers and supports shall be external of insulation.
2. Install MSS SP-58, Type 40 protective shields on all insulated piping. 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 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.

b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
d. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.

## 3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

## 3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

C. Any vertical structural members required to form overhead attachments for hangers or equipment supports shall be located adjacent to walls and any horizontal members be adjacent to the roof structure.

## 3.5 ADJUSTING

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

## 3.6 PAINTING

A. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint.

END OF SECTION 15060

# SECTION 15194 - FUEL GAS PIPING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes fuel gas piping, specialties, and accessories within the building.

### 1.3 SUBMITTALS

A. Product Data: For the following:

1. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

### 1.4 QUALITY ASSURANCE

A. ANSI Compliance: Comply with ANSI Z223.1, "National Fuel Gas Code."

B. NFPA Compliance: Fabricate and install fuel gas system in accordance with NFPA 54 "National Fuel Gas Code."

C. Utility Compliance: Fabricate and install fuel gas system in accordance with local gas utility company.

D. Local Code Compliance: Fabricate and install fuel gas system in accordance with local gas code.

### 1.5 COORDINATION

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

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

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

A. Refer to "Pipe and Fitting Material Schedule" on Drawings for applications of pipe, tube, fitting, and joining materials.

## 2.2 SPECIALTY VALVES

A. General: Valves required for fuel gas systems include the following types:

1. Gas Cocks 2 Inches and Smaller: 150 psi, non-shock WOG, bronze straightway cock, flat or square head, threaded ends.
2. Gas Cocks 2-1/2 Inches and Larger: 125 psi non-shock WOG, iron body bronze mounted, straightway cock, square head, flanged ends.

B. Electrically Operated Gas Valves (serving cooking equipment under range hood): UL 429, bronze, aluminum, or cast-iron body solenoid valve; 120-V ac, 60 Hz, Class B, continuous-duty molded coil. Include NEMA ISC 6, Type 4, coil enclosure and electrically opened and closed dual coils. Valve position shall normally be closed.

## 2.3 SERVICE METERS

A. Service Meters: Service meter loop, including meter, valves and pressure regulators, provided and installed by the serving Utility Company. Contractor verify requirements and included all costs for complete meter loop installation and connection thereto.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

B. Comply with ANSI Z223.1, "Prevention of Accidental Ignition" Paragraph.

## 3.2 SERVICE ENTRANCE PIPING

A. Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

1. Exterior fuel gas distribution system piping, service pressure regulator, and service meter will be provided by servicing Gas Utility Company.

B. Install dielectric fitting downstream from and adjacent to each service meter unless meter is supported from service-meter bar with integral dielectric fitting. Install shutoff valve downstream from and adjacent to dielectric fitting. Refer to Division 15 Section 15050, "Basic Mechanical Materials and Methods," for dielectric fittings.

## 3.3 PIPING APPLICATIONS

A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.

B. Fuel Gas Piping: Refer to "Pipe and Fitting Material Schedule" on the Drawings.

## 3.4 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig (3.45 kPa) or Less: Appliance connector valve or gas stop.

B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig (3.45 to 13.8 kPa): Gas stop or gas valve.

C. Appliance Shutoff Valves for Pressure 2 to 5 psig (13.8 to 34.5 kPa): Gas valve.

D. Piping Line Valves, NPS 2 (DN 50) and Smaller: Gas valve.

E. Piping Line Valves, NPS 2-1/2 (DN 65) and Larger: Plug valve or general-duty valve.

F. Valves at Service Meter, NPS 2 (DN 50) and Smaller: Gas valve.

G. Valves at Service Meter, NPS 2-1/2 (DN 65) and Larger: Plug valve.

## 3.5 PIPING INSTALLATION

A. Refer to Division 15 Section 15050, "Basic Mechanical Materials and Methods," for basic piping installation requirements.

B. Concealed Locations:

1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
2. In Floor: Do not install gas piping in or below floor slab.
3. In Partitions: Do not install concealed piping in solid partitions or walls.

    a. Exception: Piping passing through partitions or walls, provide sleeves.

C. Drips and Sediment Traps: Install drips at points where condensate or sediment may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches (75 mm) long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

D. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

E. Install flanges on valves, specialties, and equipment having NPS 2-1/2 (DN 65) and larger connections.

F. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

## 3.6 JOINT CONSTRUCTION

A. Refer to "Piping and Fitting Material Schedule" for basic piping joint construction.

B. Use materials suitable for fuel gas.

## 3.7 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section 15060, "Hangers and Supports," for pipe hanger and support devices.

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 meters); minimum rod size, 1/2 inch (13 mm).
5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (16 mm).

## 3.8 CONNECTIONS

A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.

B. Install piping adjacent to appliances to allow service and maintenance.

C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 12 inches of each appliance. Install union downstream from valve.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

E. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
2. Do not use gas pipe as grounding electrode.

## 3.9 PAINTING

A. Use materials and procedures in Division 9 Section "Painting," "Exterior Paint Schedule" Article, "Ferrous Metal" Paragraph, "Full-Gloss, Alkyd-Enamel Finish" Subparagraph.

B. Paint exterior service meters, pressure regulators, and specialty valves.

1. Color: Safety Yellow.

## 3.10 FIELD QUALITY CONTROL

A. Inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging," and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

D. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.

E. Verify correct pressure settings for pressure regulators.

F. Verify that specified piping tests are complete.

## 3.11 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION 15194

# SECTION 15546 - LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes low-intensity, gas-fired, forced-draft and draft-induced radiant heaters.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

### 1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

### 1.5 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of radiant heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Period: All warranty periods listed below are from date of Substantial Completion.

a. Burner Assembly: Five years.
b. Combustion and Emitter Tubes: Five years.
c. Heater Controls: One year.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. CSA certified, with CSA Seal and certification number clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.

B. UL listed and labeled, with UL label clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 FORCED-DRAFT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Calcana Industries Ltd.
2. Combustion Research Corporation.
3. Detroit Radiant Products Company.
4. Roberts-Gordon, LLC.
5. Schwank Group.
6. Solaronics, Inc.
7. Space-Ray; Division of Gas Fired Products, Inc.
8. Sterling Heating, Ventilation & Air-Conditioning Products; a Mestek company.
9. Thomas & Betts Corporation.

B. Description: Factory-assembled, indoor, overhead-mounted, electrically controlled, low-intensity, infrared radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.

C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

D. Burner Assembly:

1. Combustion-Air Inlet: Non-ducted, unvented.
2. Ignition System: Direct spark 24/25-V ac or 115/120-V ac with flame rod sensing capabilities and self-diagnostic control module.

E. Combustion Chamber: 4-inch- (100-mm-) diameter, 16-gage, stainless-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish.

F. Emitter Tube: 4-inch- (100-mm-) diameter, 16-gage, stainless-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish. Emitter tubing shall be equipped with baffles to maximize heating efficiency.

1. Tubing Connections: Stainless-steel threaded couplings.

G. Reflector: Polished aluminum, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Reflectors or entire heater shall accommodate rotational adjustment from horizontal to a minimum 30-degree tilt from vertical.

H. Capacities and Characteristics: Provide forced draft radiant heaters as noted on the drawings.

## 2.3 DRAFT-INDUCED HEATERS

A. Manufacturers: Subject to compliance with requirements,:

1. Combustion Research Corporation.
2. Detroit Radiant Products Company.
3. Roberts-Gordon, LLC.
4. Schwank Group.
5. Solaronics, Inc.
6. Space-Ray; Division of Gas Fired Products, Inc.

B. Description: Factory-assembled, indoor, overhead-mounted, electrically controlled, low-intensity, infrared radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.

C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

D. Burner Assembly:

1. Combustion-Air Inlet: Non-ducted, unvented.
2. Ignition System: Direct spark 24/25-V ac or 115/120-V ac with flame rod sensing capabilities and self-diagnostic control module.

E. Combustion Chamber: 4-inch- (100-mm-) diameter, 16-gage, stainless-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish.

F. Emitter Tube: 4-inch- (100-mm-) diameter, 16-gage, stainless-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish. Emitter tubing shall be equipped with baffles to maximize heating efficiency.

1. Tubing Connections: Stainless-steel threaded couplings.

G. Vacuum Exhaust Fan: Dynamically balanced, direct-driven, isolated from emitter tubing exhaust system by high-temperature flexible vibration isolation connector. Fan and connector to have a minimum temperature rating of 450 deg F (232 deg C).

1. Motors: General requirements for motors are specified in Section 15055 "Common Motor Requirements for HVAC Equipment."
2. Balancing Dampers: Plate type, mounted in cast, double-flange fitting with vacuum test plug.
3. Filter: Cartridge type for mounting on burner housing.
4. Vent Termination: Vertical through roof or Horizontal though side-wall with vent caps.

H. Reflector: Polished aluminum, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Reflectors or entire heater shall accommodate rotational adjustment from horizontal to a minimum 30-degree tilt from vertical.

I. Capacities and Characteristics: Provide draft induced radiant heaters as noted on the drawings.

## 2.4 CONTROLS AND SAFETIES

A. Gas Control Valve: Single or Two-stage, regulated redundant 24-V ac gas valve that contains pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

B. Failure Safeguards: 100 percent shutoff of gas flow in the event of flame or power failure.

C. Prepurge of air control system prior to burner ignition.

D. Safety lockout of burner after three consecutive ignition failures and flame is not reestablished within trial ignition period.

E. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.

F. Control Panel Interlock: Stops burner if panel is open.

G. Indicator Lights: "Airflow-on" and "burner-on" indicator lights.

H. Thermostat: Single-stage, wall-mounted type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.

1. Control Transformer: Integrally mounted.

I. Thermostat: Two-stage, wall-mounted type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.

1. Control Transformer: Integrally mounted.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Equipment Installation: Install gas-fired, radiant heaters and associated gas features and systems according to NFPA 54.

B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments or Mount to substrate using manufacturer's rigid mounting kits or custom fabricated brackets.

1. Comply with requirements for hangers and supports specified in Section 15060 "Hangers and Supports for HVAC Piping and Equipment."

C. Maintain manufacturers' recommended clearances for combustibles.

D. Gas Piping: Comply with Section 15195 "Fuel Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

1. Gas Connections: Connect gas piping to radiant heaters according to NFPA 54.

E. Where installing piping adjacent to gas-fired, radiant heaters, allow space for service and maintenance.

F. Vent Connections: Comply with Section 15550 "Breechings, Chimneys, and Stacks."

G. Electrical Connections: Comply with applicable requirements in Section 16120 "Conductors and Cables."

1. Install electrical devices furnished with heaters but not specified to be factory mounted.

## 3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify bearing lubrication.
3. Verify proper motor rotation.
4. Test Reports: Prepare a written report to record the following:

a. Test procedures used.
b. Test results that comply with requirements.
c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

B. Gas-fired, radiant heaters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

## 3.3 ADJUSTING

A. Adjust initial-temperature set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

END OF SECTION 15546

# SECTION 15971 - BUILDING MANAGEMENT AND CONTROL SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 DESCRIPTION OF WORK

A. Extent of electric-electronic temperature control systems work is indicated by Drawings and Schedules, and by requirements of this Section.

B. The BMCS shall fully integrate with the existing facility infrastructure systems with user access to all system data over a secure Intranet within the building. Field level controllers shall communicate via Johnson Controls N2 protocol, hard-wired networked, and mapped to the existing Johnson Controls MS-NAE4510 supervisory controller.

C. The BMCS shall not communicate to third party systems, other energy management systems, fire-life safety systems, or other building management related devices as part of this contract.

D. Control sequences are specified on the Drawings.

E. Refer to Division 16 Sections for power wiring to line voltage devices; not work of this section.

F. Refer to Division 16 Sections for control wiring necessary for electric- electronic temperature control systems; not work of this Section.

### 1.3 QUALITY ASSURANCE

A. Manufacturer: Firms regularly engaged in manufacture of electric-electronic temperature control equipment, of types and sizes which are similar to required equipment, and which have been in satisfactory use in similar service for not less than 5 years. Manufacturer shall have an established factory authorized service organization in Shreveport, Louisiana.

B. Installer: A firm specializing and experienced in electric-electronic control system installations for not less than 5 years.

C. Electrical Standards: Provide electrical products which have been tested, listed, and labeled by Underwriters' Laboratories (UL) and comply with NEMA standards.

D. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric-electronic temperature control systems.

1.4 SUBMITTALS

A. Submit 5 complete sets of documentation in the following phased delivery schedule:

1. Valve and damper schedules
2. Equipment data cut sheets
3. System schematics, including:

    a. Sequence of operations
    b. Point names
    c. Point addresses
    d. Point to point wiring
    e. Interface wiring diagrams
    f. Panel layouts
    g. System riser diagrams

4. AutoCAD compatible or equal as-built drawings

B. Upon project completion, provide owner with BMCS programming software and submit operation and maintenance manuals, consisting of the following:

1. Manufacturer's equipment parts list of all functional components of the system
2. Description of sequence of operations
3. As-Built interconnection wiring diagrams
4. User’s documentation containing product, system architectural and programming information.
5. Trunk cable schematic showing remote electronic panel locations, and all trunk data
6. List of connected data points, including panels to which they are connected and input device
7. Conduit routing diagrams
8. Copy of the warranty
9. Operating and maintenance cautions and instructions
10. Recommended spare parts list

1.5 DELIVERY, STORAGE AND HANDLING

A. Provide factory shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from weather.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. General: Provide electric-electronic temperature control products in sizes and capacities indicated, consisting of valves, dampers, thermostats, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide Manufacturer's standard temperature control system components as indicated by published product information, designed and constructed as recommended by Manufacturer. All new

components shall be manufactured to be completely compatible and interchangeable with existing Johnson Controls Metasys system installed elsewhere on Base. Provide temperature control systems with the following functional and construction features as indicated.

B. Control Valves: Provide factory-fabricated electrical control valves of type, body material and pressure class indicated. Where type or body material is not indicated, provide selection as determined by Manufacturer for installation requirements and pressure class, based on maximum pressure and temperature rating of piping system. Except as otherwise indicated, provide valves which mate and match material of connecting piping. Equip control valves with control valve motors, and with proper shutoff ratings for each individual application. All valves shall be proportional control, except for fan coil units which shall be on/off.

C. Water Service Valves: Equal percentage characteristics with range of 50 to 1.

D. Single-Seated Valves: Cage type trim, providing seating and guiding surfaces for plug on "top and bottom" guided plugs.

E. Valve Trim and Stems: Polished stainless steel for all sizes, trim as recommended by Manufacturer.

F. Packing: Spring-loaded Teflon, self-adjusting.

G. Valve Pressure Drop: Two (2) psi maximum unless noted otherwise.

H. DDC Controller: All application specific controllers shall be furnished with communications input/output hardware to enable two way communications on existing BAFB N2 and high speed N1 communications networks. No adapters, converters, interpreters or other "black box" communications adapters are acceptable in order to gain communications compatibility to existing communications protocol.

1. Temperature control shall include microprocessor based controller(s), one or more controllers shall be provided based on the number of input-output points required for all field sensors and output devices. The controller(s) shall be factory mounted and wired in a factory enclosure complete with required power supply, transformer, surge transient protection, relays, digital to analog converters, and terminal strips. Controllers shall be capable of providing all inputs/outputs as required.
2. The Controller shall utilize EEPROM and/or RAM memory. RAM memory shall be provided with 72 hour battery backup minimum and an automatic battery charger.
3. The Temperature control panel shall provide for the connection of the following inputs/outputs: resistance type sensing elements, potentiometer, 0 - 5 VDC, 0 - 10 V, 0 - 5 MV, 0 - 50 MV, 0 - 20 MA voltages, 4-20 ma dc, contact closures and other inputs required for the operation of the air handling units as described in the Sequence of Operation.
4. The Controller shall be designed so that, once programmed, the setpoint changes and diagnostic can be performed without using any portable handheld device. Programming and setpoint adjustments shall be provided at the built-in keypad on the DDC controller or at the remote operator workstations located at the remote operator workstations located at the Energy Management and Controls Shop - Building 4432.
5. The Controller and associated communications network shall not malfunction due to EMI field generated from operator's transmitters.

I. Software: Provide all software necessary to operate the Temperature controller in all modes. Minimum features only are specified herein. The Contractor shall insure that the software furnished provides all requirements specified or necessary.

1. Provide the following functions, fully implemented and operational, within the Temperature control panel.

    a. Constant scanning of connected inputs and verification of alarm conditions and control outputs.
    b. Continuous display at the DDC network terminals of requested input/output values.
    c. Notification to remote operator workstation by exception or request.
    d. Controller diagnostics shall indicate errors or failures of internal or external electronics.
    e. Operating system software shall operate independently of any central computer.
    f. System shall provide automatic restart of equipment based on current operating program without operator intervention.
    g. Programs shall be stored in EEPROM so that programs are not lost on power failure.
    h. Controllers shall be Johnson Control model “DX-9100”, "UNT", or equal as needed for application.

J. System and Sensor Accuracy: The system shall maintain an end to end accuracy for two years from sensor to diagnostic display for the applications specified.

1. Space temperature with a range of 50 to 85 degrees F, plus or minus 0.75 degrees F for conditioned space.
2. Outside Air (OA) temperature with a range of minus 40 to plus 130 degrees F, plus or minus 2.0 degrees F, with a sub-range of plus 30 to 100 degrees F, plus or minus 1.0 degree F.
3. Water temperature with a range of 30 to 100 degrees F, plus or minus 0.75 degrees F; the range of 100 to 250 degrees F within plus or minus 2.0 degrees F.

K. Temperature Sensors: Temperature sensors shall be resistance temperature detectors (RTD's). Sensing element shall be nickel with common reference of 1000 ohms at 70 degrees F. Provide sensing elements as follows:

1. Liquid immersion RTD shall be provided with brass thermowell. Length of sensor and thermowell shall be selected based on diameter of pipe to facilitate accurate, reliable, homogeneous and steady temperature sensing of the liquids.
2. Room temperature sensors shall have setpoint adjusters with no thermometer.

L. Current Sensing Status Relays: The on and off status of each pump motor and fan motor shall be indicated via a current sensing relay and current transformer on one of the power legs to the associated motor. Relay shall provide dry contact closure with motor on but shall indicate open contact whenever fan belt breaks or if the motor fails to run. Current sensing relay and start/stop relay shall not be combination type.

M. Valve and Damper Operators: Valve operators shall be electronic type. Operator shall be designed for maximum pressure differential or torque required (plus 50 percent) across the valve. Valve operators shall be complete with feedback position indicator for interface to DDC controller. Operators shall be spring return type to fail safe in event of signal or power loss.

N. Fire Protection Thermostats: Provide UL-listed fire protection thermostats. Connect thermostats which are capable of stopping fans in event of excessive temperatures in fan control circuits. Provide thermostats with fixed settings to operate at 125 degrees F. Provide manual reset type thermostats.

O. Electric Room Thermostats for Fan Coil Units: Provide heating/cooling thermostat with heat-off-cool switch and on-auto fan switch. Thermostat shall have a SPDT switch which will energize cooling in one position and heating in the other.

P. Local Control Panels: Provide a central control panel located in the mechanical room with suitable brackets for wall mounting. Locate panel adjacent to systems served.

Q. Provide standard steel cabinets as required to contain temperature controllers, relays, switches, and similar devices, except limit controllers and other devices excluded in sequence of operations. Provide full-enclosure cabinets with painted gray finish.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. General: Install system and materials in accordance with Manufacturer's instructions and roughing-in Drawings and details on Drawings. Mount controllers at convenient locations and heights.

B. Energy Monitoring and Control System (EMCS): Provide connection to the existing Johnson Controls EMCS. Provide all required sensors, wiring, hardware, and software to accomplish the sequence of control indicated.

C. Number-code or color-code conductors, excluding those used for local individual room controls, appropriately for future identification and servicing of control system.

D. All exposed wiring, low and line voltage subject to mechanical damage, shall be run in conduit. Line and low voltage wiring shall be run in separate conduits. Concealed but accessible wiring, except in mechanical rooms and areas where other conduit and piping are exposed shall run in UL plenum rated cable as approved by local codes unless expressly restricted by requirements in specification. Cables will be bundled together and supported to the structure every five feet.

### 3.2 GRAPHICS

A. General: All graphics shall be stored on the Application Data Exchange Server located at EMCS shop on base. Floorplan and system graphics shall be consistent with existing templates.

B. Floorplan graphics shall include all mechanical equipment and respective thermostat locations on the most current building layout.

C. System graphics shall be dynamic.

### 3.3 FINAL ADJUSTMENT

A. After completion of installation, adjust thermostats, control valves, motors, and similar equipment provided as work of this section.

B. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer (or factory authorized installer) of primary temperature control system. Provide certification that all work has been tested, balanced, and adjusted and that all systems are

working as intended. The contractor shall provide qualified personnel for at least an 8 hour period to demonstrate and to train Government personnel in proper operation of the systems.

END OF SECTION 15971

# SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

B. Codes and Standards: Where indicated, the referenced edition shall govern. Where not indicated, the latest edition shall govern.

### 1.2 SUMMARY

A. This Section includes the following:

1. Supporting devices for electrical components.
2. Electrical identification.
3. Control wiring.
4. Electrical demolition.
5. Cutting and patching for electrical construction.
6. Touchup painting.

### 1.3 SUBMITTALS

A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

### 1.4 DEFINITIONS

A. General Explanation: A substantial amount of the Contract Document Specification language constitutes specific definitions for terms found in other Contract Documents, including the Drawings which must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated thereon. Certain terms used repetitiously in the Contract Documents are defined generally in this Article.

B. General Requirements: The provisions or requirements of the Division 1 Sections. The General Requirements apply to the entire work of the Contract, and where so indicated, to other elements of work which are included in the project.

C. Indicated: The term "Indicated" is a cross reference to the Details, the Notes, or the Schedules on the Drawings, other Paragraphs or Schedules in the Specifications, and similar means of recording requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader locate the cross reference, and no limitation of location is intended except as specifically noted.

D. Directed, Requested, Etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by the Contracting Officer's Representative," "requested by the Contracting Officer's Representative," etc. However, no such implied meaning will be interpreted to extend the Contracting Officer's Representative's responsibility into the Contractor's area of construction supervision.

E. Refer: Used to indicate that the subject is defined or specified in further detail at another location in the Contract Documents, or elsewhere as indicated. Except as otherwise noted, "refer" does not imply that the Contractor must purchase or subcontract the subject work in any special manner.

F. Approve: Where used in conjunction with the Contracting Officer's Representative's response to submittals, requests, applications, inquiries, reports and claims by the Contractor, the meaning of the term "approved" will be held to the limitations of the Contracting Officer's Representative's responsibilities and duties as specified in the General and Supplementary Conditions. In no case will "approval" by the Contracting Officer's Representative be interpreted as a release of the Contractor from responsibilities to fulfill the requirements of the Contract Documents.

G. Project Site: The space available to the Contractor for the performance of the work, either exclusively or in conjunction with others performing other work as part of the project. The extent of the project site may or may not be identical with the description of the land upon which the project is to be built.

H. Furnish: Except as otherwise defined in greater detail, the term "furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

I. Install: Except as otherwise defined in greater detail, the term "install" is used to describe operations of the project site including unloading, unpacking, assembly, erection, placing, anchoring, connecting utilities, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.

J. Provide: Except as otherwise defined in greater detail, the term "provide" means furnish and install, complete and ready for the intended use, as applicable in each instance.

K. Installer: The entity (person or firm) engaged by the Contractor or its Subcontractor or Sub-subcontractor for the performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

## 1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 (2011).

## 1.6 HAZARDOUS MATERIALS

A. Asbestos: No asbestos-containing materials have been identified on items that are indicated to be disturbed. If asbestos-containing materials are encountered, comply with the following:

Upon encountering any previously unidentified materials which he suspects may contain asbestos, the Contractor shall immediately cease all work in the immediate vicinity of the suspected materials and notify the Designer and the Owner. The Owner shall retain consultants to identify the suspected materials. Upon identification, the Owner reserves the right to contract separately for the removal, or require the Contractor to remove said materials in accordance with the following provision. In any case, the work shall be performed by a licensed and certified Abatement Contractor.

The Louisiana Department of Environmental Quality (D.E.Q.) has issued the Louisiana Emission Standards for Hazardous Air Pollutants. Where asbestos is encountered in a project, the Contractor shall comply with all laws and ordinances pertaining to asbestos handling and abatement, including the latest revision of LAC 33:111, Chapter 25, Subchapter F, Emission Standards for Hazardous Air Pollutants, LAC 33:111, Chapter 27, Asbestos Containing Materials in Schools and Public Buildings and LAC 33:111, Chapter 51, Subchapter M, Section 5151, Emission Standards for Asbestos.

Notification should be addressed to:

Asbestos Coordinator
Louisiana Department of Environmental Quality
Air Quality Division
Post Office Box 82135
Baton Rouge, Louisiana 70884-2135

If the Owner chooses to remove any previously unidentified materials by utilizing different Contractors, the Contractor shall cooperate fully with the Owner's consultants and asbestos abatement Contractor permitting them full access to the project, and shall not resume work in the vicinity of the suspected materials until advised by the Designer and the Owner that it is safe to do so.

## 1.7 COORDINATION

A. The electrical Plans and Specifications are a portion of the entire project. Other portions of the project contain information and requirements that will affect the electrical work. It is the responsibility of the Electrical Contractor to review all of the Contract Documents and to include those requirements in the bid.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the work.

C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16 inch (14 mm) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

F. Expansion Anchors: Carbon-steel wedge or sleeve type.

G. Toggle Bolts: All-steel springhead type.

H. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each cable size.

1. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.

C. Colored Adhesive Marking Tape for Wires, and Cables: Self-adhesive vinyl tape, not less than 3/4 inch wide by 3 mils thick (18 mm wide by 0.08 mm thick).

D. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

E. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16 inch (1.6 mm) minimum thickness for signs up to 20 sq. inch (129 sq. cm) and 1/8 inch (3.2 mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.

F. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

G. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.3 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom, but no less than that required by NEC.

B. Clearances: Coordinate with other trades and/or existing conditions to maintain code required clearances above, below, and around electrical equipment.

C. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Selection of Supports: Comply with manufacturer's written instructions.

D. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200 lb (90 kg) design load.

3.3 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps. Clamps less than 7 feet above the floor shall be one-piece without protruding edges or bolts.

F. Install 1/4 inch (6 mm) diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

H. Install metal channel racks for mounting cabinets, disconnect switches, control enclosures, pull and junction boxes, and other devices unless components are mounted directly to structural elements of adequate strength. Field galvanize galvanized members that have been field cut.

I. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. Existing Concrete: Expansion bolts.
4. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
5. Steel: Welded threaded studs or spring-tension clamps on steel.

    a. Field Welding: No field welding of supports to structural members will be allowed.

6. Light Steel: Sheet-metal screws. Do not penetrate outer skin of building from within.
7. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

## 3.4 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

E. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Black.
2. Phase B: Red.
3. Phase C: Blue.

F. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Brown.
2. Phase B: Orange.
3. Phase C: Yellow.

G. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

H. Install engraved-laminated signs with black letters on white background with minimum 3/8 inch (9 mm) high lettering for equipment designations for switchgear or description of load being fed or controlled in the case of disconnects or contactors.

1. Install signs with red letters on white background when identifying circuit numbers connected to the emergency power distribution system.

## 3.5 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials shall be fire resistant per ASTM E119 fire test conditions and shall be non-combustible when tested per ASTM E136. Melting point shall exceed 2000 degrees F per ASTM C24. Fireproofing installation for openings in rated floors or partitions shall provide an airtight seal.

## 3.6 EQUIPMENT AND CONTROL WIRING

A. Wire in and connect every motor and item of equipment re-furbished as a part of this Contract, including those furnished under other Divisions. Provide all required boxes, conduit, conductors, etc as required for reconnection of re-furbished motors. Motors and equipment furnished under other Divisions will be installed under that Division.

B. Motor starters and variable speed drives will be furnished under the division that the motors being controlled are furnished, and will be installed under Division 16 by the Electrical

Contractor unless controllers are integral to the equipment. Installation includes mounting, connection to power and grounding.

C. Control Wiring: All control wiring and interlock wiring is included under the Division that furnishes the motors.

## 3.7 DEMOLITION

A. Protect existing electrical equipment and installations not indicated to be removed. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, appearance, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Existing Work to Remain: Maintain feed, or provide new feed to equipment and devices that are not being removed.

D. Remove demolished material from project site.

E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

## 3.8 SEQUENCING AND SCHEDULING

A. Electrical power and system interruptions shall be held to a minimum and will be permitted only at times approved by the Owner. The Owner may require that any interruptions be during nights, weekends, holidays, etc. Provide any required overtime work at no additional cost to Owner.

B. Do not interrupt feed to any service, feeder or branch circuit feeding facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to make temporary provisions where required according to requirements indicated:

1. Notify Owner no fewer than seven (7) days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.
3. Provide all temporary facilities and services, including fire watch, required to maintain operation, security, and life safety.

## 3.9 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

## 3.10 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Supporting devices for electrical components.
2. Electrical identification.
3. Electrical demolition.
4. Cutting and patching for electrical construction.
5. Touchup painting.

## 3.11 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint:

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

## 3.12 CLEANING AND PROTECTION

A. Upon completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 16050

# SECTION 16060 - GROUNDING AND BONDING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment, plus Underground distribution grounding.

### 1.3 SUBMITTALS

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

### 1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. Comply with NFPA 70 (2011)

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Twist-On Connectors: Plastic body with coiled copper alloy wire forming threads.

D. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

E. Underground Mechanical Connectors: Bolted-pressure type or compression type, listed for underground application.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 inch by 8 feet (19 mm by 3 meters) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 14 AWG and smaller, and stranded conductors for No. 12 AWG and larger, unless otherwise indicated.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Single-phase motor and appliance branch circuits.
3. Three-phase motor and appliance branch circuits.
4. Flexible raceway runs.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

END OF SECTION 16060

# SECTION 16120 - CONDUCTORS AND CABLES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

### 1.3 SUBMITTALS

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

B. Field Quality-Control Test Reports: From Contractor.

### 1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 (2011).

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS AND CABLES

A. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

B. Conductor Material: Copper complying with NEMA WC 5 or 7; stranded or solid conductor for No. 14 AWG and smaller, stranded for No. 12 AWG and larger.

C. Conductor Insulation Types: Type THHN-THWN complying with NEMA WC 5 or 7 as applicable.

### 2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated. Push in splice and insulation displacement type connectors shall not be used.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Feeders and Branch Circuits: Type THHN-THWN, single conductors in raceway. Minimum size #12 AWG or larger where required for voltage drop. Where branch circuits exceed 100 feet in length, use minimum #10 AWG.

B. Class 1 Control Circuits: Type THHN-THWN, in raceway. Minimum size #14 AWG.

C. Class 2 Control Circuits: Type THHN-THWN, in raceway or Power-limited cable in raceways. Size as recommended by equipment manufacturer.

3.2 INSTALLATION

A. Run all conductors in raceways unless specifically indicated otherwise.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips; that will not damage cables or raceway.

D. Identify and color-code conductors and cables according to Division 16 Section 16050, "Basic Electrical Materials and Methods."

E. No more than three current carrying phase conductors (excluding switch legs and grounding conductors), and one grounded conductor, may be installed in any raceway.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 8 inches (200 mm) of slack.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 16120

# SECTION 16130 - RACEWAYS AND BOXES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following: Division 16 Section 16050, "Basic Electrical Materials and Methods," for supports, anchors, and identification products.

### 1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

F. Fixture Whip: Flexible wiring as specified from box to individual lighting fixture.

### 1.4 SUBMITTALS

A. Product Data: For boxes, raceways, and fittings.

### 1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 (2011).

### 1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment and fire-suppression system.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers:

1. Anamet Electrical, Inc.; Anaconda Metal Hose.
2. Electri-Flex Co.
3. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
4. LTV Steel Tubular Products Company.
5. Manhattan/CDT/Cole-Flex.
6. O-Z Gedney: Unit of General Signal.
7. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1. U. L. 6. Threaded with threaded fittings.

C. IMC: ANSI C80.6. U.L. 1242.

D. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

E. Plastic-Coated IMC and Fittings: NEMA RN 1.

F. EMT and Fittings: ANSI C80.3.U.L.797, compression type.

G. FMC: Zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.2 BOXES

A. Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electrical Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Feter Co.; Adalet-PLM Division.
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

## 2.3 FACTORY FINISHES

A. Finish: For raceway or boxes, provide manufacturer's standard finish applied to raceways and boxes before shipping.

# PART 3 - EXECUTION

## 3.1 RACEWAY APPLICATION

A. Use the following raceways for indoor installations:

1. Exposed in Unfinished Areas: EMT. Use IMC or Rigid Steel Conduit for locations subject to mechanical damage.
2. Concealed: EMT.
3. Connection to Vibrating Equipment: FMC; except in wet or damp locations, use LFMC.
4. Damp or Wet Locations: IMC.
5. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

B. Minimum Raceway Size: 3/4 inch trade size (DN 21) unless noted.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduit.

## 3.2 INSTALLATION

A. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

B. Do not support electrical equipment or raceways from ceiling grid or ceiling grid supports. Independently support all equipment and raceways directly from structural elements.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 16 Section 16050, "Basic Electrical Materials and Methods."

E. Install temporary closures to prevent foreign matter from entering raceways.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

H. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

I. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts; one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200 lb (90 kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

K. Flexible Connections: Use maximum of 12 inches (35 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

## 3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings and finishes are without damage or deterioration at time of Substantial Completion. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

## 3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 16130

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Motor-rated switches.
2. Device wall plates.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. PVC: Polyvinyl chloride.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70 (2011).

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type of wiring device):

1. Motor Rated Switches and manual motor starters:

a. General Electric CR101 Series
b. Square-D FG or KG Series
c. P & S 78XX Series

2.2 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished stainless steel. Material for Unfinished Spaces: Galvanized steel.
3. Material for Wet Locations: Thermoplastic, with spring-loaded lift cover, and listed and labeled for use in "wet locations". For receptacles, listing shall apply with plug cap inserted.

2.3 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: Ivory, unless otherwise indicated or required by NFPA 70.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Basic Electrical Materials and Methods."

1. Switches and Device Plates: Identify panelboard and circuit number from which served. Apply hot, stamped adhesive label, not less than 5/16” wide with 1/8” lettering on face of device plate, and durable wire markers or tags inside outlet boxes.

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D. Do not connect stranded wire to devices using back wired push-in feature.

E. When terminating stranded conductors on devices, ends of strands shall be contained by insulation so that all strands must be held by screw.

END OF SECTION 16140

SECTION 16442 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes transient voltage suppression panelboards.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports including the following:

1. Test procedures used.

2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Panelboard Schedules: For installation in panelboards.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

## 1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70 (2011).

F. Comply with NFPA 70E (2009). Arc Flash labels furnished for new panelboards shall meet the requirements of NFPA 70E, "Standard for Electrical Safety in the Workplace."

## 1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Contracting Officer's Representative no fewer than two weeks days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Contracting Officer's Representative written permission.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 MANUFACTURED UNITS

A. Enclosures: Surface-mounted cabinets. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, Type 3R.
b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4 .

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

B. Phase and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

C. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Mechanical type.
2. Ground Lugs and Bus Configured Terminators: Mechanical type.

D. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

## 2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

## 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Products: Subject to compliance with requirements, provide one of the products specified.

1. Cutler-Hammer: PRL1a (120/208V).
2. General Electric: AQ Series (120/208V).
3. Siemens: Sentron S1 (120/208V).
4. Square-D: NQOD (120/208V).

B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

C. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.5 TRANSIENT VOLTAGE SUPPRESSION PANELBOARDS

A. Manufacturers: Products: Subject to compliance with requirements, provide one of the products specified.

1. Cutler-Hammer: As specified above with integral "Clipper" TVSS
2. General Electric: As specified above with integral "ME" TVSS.
3. Siemens: As specified above with integral "TPS" TVSS.
4. Square-D: As specified above with integral "Surge Logic" TVSS.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

C. Main Overcurrent Devices: Thermal-magnetic circuit breaker.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

E. Bus: Copper phase and neutral buses.

F. Transient Voltage Suppression Device: IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.

1. Minimum Single-Impulse Current Ratings:

   a. Line to Neutral: 100,000 A.
   b. Line to Ground: 100,000 A.
   c. Neutral to Ground: 50,000 A.

2. Protection modes shall be as follows:

   a. Line to neutral.
   b. Line to ground.
   c. Neutral to ground.

3. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
4. Maximum Category C Combination Wave Clamping Voltage: 600 V, line to neutral and line to ground on 120/208 V systems.
5. Maximum UL 1449 Clamping Levels: 400 V, line to neutral and line to ground on 120/208 V systems.
6. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
7. Accessories:

   a. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
   b. Audible alarm activated on failure of any surge diversion module.
   c. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.

## 2.6 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Full module, inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Tandem or “piggyback” breakers are not acceptable.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

2. Application Listing: Appropriate for application; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

C. Mount plumb and rigid without distortion of box.

D. Install overcurrent protective devices.

E. Install filler plates in unused spaces.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

### 3.2 IDENTIFICATION

A. Create a directory to indicate installed circuit. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

C. Arc Flash Label: NFPA 70E, the Contractor shall perform an Arc Flash Hazard Analysis on all new panelboards installed under the scope of this project in order to calculate the incident energy and Hazard Risk Category at each new panel. As a minimum, Arc Flash labels shall include:

1. Hazardous Risk Category.
2. Calculated Incident Energy.
3. Flash Hazard Boundary.
4. Limited Approach Boundary.
5. Restricted Approach Boundary.
6. Prohibited Approach Boundary.
7. Bus Voltage.

### 3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

## 3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

## 3.5 CLEANING

A. Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16442

# SECTION 16461 - LOW-VOLTAGE TRANSFORMERS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary conditions and Division 1 Specifications Section, apply to the Section.

### 1.2 SUMMARY

A. This Section includes Distributions transformers of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

### 1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Indicate dimensions and weights.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and maintenance data.

### 1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

C. Comply with NFPA 70(2011).

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Electric Corporation.

2. Challenger Electrical Equipment Corp.
3. Controlled Power Company.
4. Eaton Electrical Sector; Eaton Corporation; Cutler-Hammer Products.
5. Federal Pacific Transformer Company.
6. General Electric Company.
7. Hammond Co.
8. Magnetek Power Electronics Group.
9. Micron Industries Corp.
10. Myers Power Products, Inc.
11. Siemens Energy & Automation, Inc.
12. Sola/Hevi-Duty.
13. Square D Co./Groupe Schneider NA; Schneider Electric.

## 2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Copper.

## 2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Enclosure: Ventilated, NEMA 250, Type 3R.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: ANSI 61 gray.

F. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

G. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

H. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.
2. Tested according to NEMA TP 2.

I. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

## 2.4 BUCK-BOOST TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.

B. Enclosure: Ventilated, NEMA 250, Type 2.

1. Finish Color: ANSI 61 gray.

## 2.5 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate. Nameplates are specified in Section 16050 "Basic Electrical Materials and Methods."

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions.

## 3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

    a. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
    b. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

3.3 ADJUSTING

A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION 16461