Purchasing Department
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STATE OF LOUISIANA

THE UNIVERSITY OF LOUISIANA AT MONROE
MONROE, LOUISIANA
A Member of the University of Louisiana System

June 16, 2025

Addendum No. 1
Bid #50006-072
Hemphill Hall Chiller Replacement

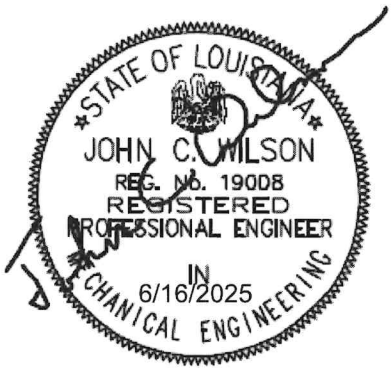
Due: July 26, 2:00 p.m.

The purpose of this addendum is for the following modifications and/or clarifications shall be made to the drawing and project manual for the Hemphill Hall Chiller Replacement.

Please acknowledge receipt of this addendum on bid proposal.

_____	_____	_____
Authorized Signature	Company Name	Date

Shakeya Bennett
Procurement Specialist



ADDENDUM #1
HEMPHILL HALL CHILLER REPLACEMENT
UNIVERSITY OF LOUISIANA - MONROE
MONROE, LOUISIANA
BID NO. 50006-072
GUTH PN 22-7321

June 16, 2025

THE FOLLOWING MODIFICATIONS AND/OR CLARIFICATIONS SHALL BE MADE TO THE DRAWING AND PROJECT MANUAL FOR THE CAPTIONED PROJECT:

SPECIFICATIONS

1. Table of Contents, page TOC-i
   a. Delete Line 00 11 13 Advertisement for Bid and the associated specification section.
   b. Delete 00 21 13 Instructions to Bidders and the associated specification section.
   c. Delete 00 41 13 Bid Form and the associated specification section.
   d. Delete 00 41 14 Bid Bond and the associated specification section.
   e. Delete 00 44 13 University of Louisiana at Monroe Owner Contractor Contract and the associated specification section.
   f. Delete 00 45 13 Attestation Affidavit and the associated specification section.
   g. Delete 00 47 13 Schedule of Values and the associated specification section.
   h. Delete 00 80 00 Change Order and the associated specification section.

2. Replace Section 00 00 02 Seals and Certifications with the one included in this Addendum.

3. Section 23 25 00 HVAC Water Treatment
   a. Para 2.2 Chemicals: The user agency's chemical supplier is
      Joel Holland
      Thornton, Musso, Bellemin, Inc.
      318-237-6776
      joel@tmbwater.com

4. Section 23 09 23 Building Management and Control System

   a. Delete this Section and substitute section 23 09 23 included in this Addendum.

5. Add specification section 26 05 00, 26 05 19, 26 05 26, 26 05 33, 26 24 16, 26 28 13 and 26 43 13 included in this Addendum.

6. Page 10, No. 9 Construction Schedule/Outages: Change 21 days to 360 consecutive calendar days.

DRAWINGS

1. Sheet M3

    a. First Floor Plan – Mechanical Renovation: The minimum height of chilled water and condensed water piping feeding CH-1 shall be 10".

EQUIPMENT APPROVALS

The following manufacturers are approved as substitutes for the items listed, subject to compliance with drawings, specifications, space limitation requirements, and comparison to the specified unit:

1. Variable frequency drivers:
    a. Yaskawa HV600 Series
2. Water cooled rotary-screw water chillers:
    a. Quantech QTC Series by JCI

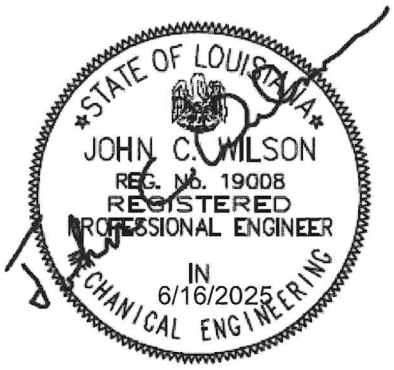
ULM – HEMPHILL HALL
CHILLER REPLACEMENT
UNIVERSITY OF LOUISIANA - MONROE
MONROE, LOUISIANA

BID NUMBER 50006-072

GUTH PN 22-7321

SEALS

Specification Divisions/Sections prepared under my responsible supervision:
Division 00 Procurement and Contracting requirements
Division 01 General Requirements
Division 02 Site Construction
Division 03 Concrete
Division 23 Heating, Ventilation, and Air Conditioning



John C. Wilson, P.E., President
Mechanical Engineer – LA License 19008

ULM – HEMPHILL HALL
CHILLER REPLACEMENT
UNIVERSITY OF LOUISIANA - MONROE
MONROE, LOUISIANA

BID NUMBER 50006-072

GUTH PN 22-7321

SEALS

Specification Divisions/Sections prepared under my responsible supervision:
Division 26 Electrical

J. Patrick Foreman, P.E.
Electrical Engineer – LA License 22378

SECTION 23 09 23 - BUILDING MANAGEMENT AND CONTROL SYSTEM

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 specified in this Section.

1.2 SUMMARY

A. This section describes the Enterprise Level Energy Management Systems (ELEMS) scope of work for the project. This section also coordinates the responsibilities of the Mechanical and Electrical trade contractors pertaining to control products or systems, furnished by each trade that will be integrated by this Division.

B. All labor, material, equipment, programming, graphics and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

C. Direct digital controllers for all chillers, pumps, fans, fan coils, and AHU's shall be furnished, installed and wired by the Division 23 09 23 contractor.

D. The system network will be BACnet/MSTP or BACnet/IP.

1.3 QUALITY ASSURANCE

A. Codes and Approvals:

1. The complete BMCS installation shall be in strict accordance to the national and local electrical codes and the electrical Section of these specifications. All devices designed for or used in line voltage applications shall be UL listed. All microprocessor based remote and central devices connecting onto the primary bus (including link devices) shall be UL-Listed.
2. The system shall comply with NFPA 90A Air Conditioning and 90B Warm Air Heating, Air Conditioning.

B. Provide satisfactory operation without damage at 110 percent above and 85 percent below rated voltage and at 3 hertz variation in line frequency. Provide static, transient, and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients, and induced magnetic interference. All bus connected devices shall be a.c. coupled, or equivalent, so that any single device failure will not disrupt or halt bus communication.

C. Acceptance: The BMCS Contractor shall completely check out, calibrate, and test all connected hardware and software to insure that the system performs in accordance with the approved Specifications and sequences of operations approved.

1. Witnessed acceptance demonstration shall display and demonstrate each type of data entry to show site specific customizing capability; demonstrate parameter changes; execute digital and analog commands; and demonstrate DDC loop stability via trend of inputs and outputs.
2. The Control Contractor shall furnish software for the laptop computer to enable service of the control system and for use by the balancing Contractor during system balancing. The Control Contractor shall provide the balancing Contractor up to four hours training on the use of this software in order to exercise actuators and enter calibration and balancing parameters. Additional training or assistance required by the balancing Contractor shall be contracted directly with the Control Contractor by the balancing Contractor.

D. Submittals:

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

    a. Valve and damper schedules
    b. Equipment data cut sheets
    c. System schematics, including:

        1) Sequence of operations
        2) Point names
        3) Point addresses
        4) Point to point wiring
        5) Interface wiring diagrams
        6) Panel layouts
        7) System riser diagrams

    d. AutoCAD compatible or equal as-built drawings

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

    a. Manufacturer's equipment parts list of all functional components of the system
    b. Description of sequence of operations
    c. As-Built interconnection wiring diagrams
    d. User's documentation containing product, system architectural and programming information.
    e. Trunk cable schematic showing remote electronic panel locations, and all trunk data
    f. List of connected data points, including panels to which they are connected and input device
    g. Conduit routing diagrams
    h. Copy of the warranty
    i. Operating and maintenance cautions and instructions
    j. Recommended spare parts list

E. Training: All training shall be by the BMCS Contractor and shall utilize Operator's Manuals and as-built documentation.

1. Operator training for the project shall include two (2) eight-hour session

encompassing modifying text and graphics, sequence of operation review, selection of all displays and reports, use of all specified OWS functions, troubleshooting of sensors (determining bad sensors), and password assignment and modification

a. This training session shall be conducted at system completion.

F. Warranty:

1. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of two years from the time of system acceptance.
2. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the Division 23 contractor at no expense to the Owner.

1.4 BUILDING MANAGEMENT AND CONTROL SYSTEM

A. The Building Automation System (BAS) contractor shall furnish and in- stall a networked system of HVAC controls. The contractor shall incorporate direct digital control (DDC) for central plant equipment.

B. Provide networking to new DDC equipment using industry accepted communication standards. System shall utilize BACnet communication according to ANSI/ASHRAE standard 135-2010 for interoperability with smart equipment, for the main IP communication trunk to the BAS Server and for peer-to-peer communication between DDC panels and devices. The system shall not be limited to only standard protocols, but shall also be able to integrate to a wide variety of third-party devices and applica- tions via drivers and gateways.

C. Provide standalone controls where called for on the drawings or sequences.

D. The BAS shall be an extension of the existing BAS system by Powers of Louisiana Please contact Erik Wientjes at 504-400-0748

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. 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. All Applied controllers shall Bacnet/IP controllers and will require an IT connection furnished by the installing contractor and that must be coordinated with the owners IT department.

2.3 SENSORS

A. 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. 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.
2. 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

B. 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.

C. 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.

2.4 Valve and Damper Operators:

A. 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.

2.5 Local Control Panels:

A. Provide a central control panel located in the mechanical room with suitable brackets for wall mounting. Locate panel adjacent to systems served.

B. 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 AND WIRING

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

C. All wiring, low and line voltage shall be run in conduit. NO EXCEPTIONS

D. The electrical contractor (Div 26) shall furnish all power wiring to electrical starters and motors.

3.2 GRAPHICAL USER INTERFACE

A. Introduction

1. The goal is to provide the end user with a fully functional set of graphics with which to operate, test and trouble shoot their systems with, while still maintaining a standard look and "feel" across all graphics.

B. Base Graphic (Graphic Template)

1. The base of the graphic consists of its background color and title bar. The title bar includes a forward, back, home, schedule, trends, alarm, and help buttons. Outdoor air temperature and humidity (if available) should be on the title bar also.

a. Standards for the "base" of all graphics should include:

1) All graphics should be sized to fit nicely on a monitor running 1280x1024 resolution and shall scale to any given resolution.
2) Display background should be RGB (64, 64, 64) in color.
3) Display of the frame and navigation tree should be RGB (32, 32, 32) in color.
4) Interactive navigation tree should be located on the left hand

2. The navigation tree graphic should:

a. Select a unit or summery to view
b. Customer logo at the top

c. Controls Contractor logo at the bottom

3. The Unit Name and Job Name should be in Tahoma, 12pt Bold, Black.

C. Mechanical Equipment

1. All mechanical equipment graphics should match that being used. IE: absorption vs. centrifugal chillers; plate-and-frame vs. tube heat exchangers; sectional vs. fire tube boilers; air-to-air vs. heat wheel heat exchangers.

D. Sensors

1. All duct sensors, probes and meters of any kind should be animated with a "red" color around the text if the device is in the alarm state and the alarm state

is available. This is especially important for freeze-stats and smoke detectors.

E. Floor Plan Graphics

1. Floor plan graphics consist of 4 major parts:

a. Base Graphic
b. 3D Floor Plans
c. Data
d. Labeling/Legend

2. The base graphic will follow the standards for "Base Graphics" detailed earlier in this document. The actual floor plan on a graphic should be comprised of 3 parts:

a. Floor Plan Image: This should be a 3D CAD drawing which has been converted to a png image (png images support the "invisible" color). Specific layers of the CAD drawings should be turned off to leave only building wall, door, window and major partitions visible. The color of all visible layers should be Dark Grey RGB (105,105,105)
b. Room Numbering/Labeling

1) Labels shall include box/room number and change color on a gradient scale up and down in 1 degree increments with dark blue being coldest and red being the hottest.

c. Zoning; this helps visually determine what equipment is serving an area and if the equipment is maintaining a suitable comfort level

3. Data displayed on a floor plan graphic will utilize a custom created dynamic shape. This shape will display space temperature, equipment name and include a link to the equipment. As you place the cursor over a zone, the name of the zone will be located in the frame above the floor plan and can also be edited by the end user. In the event this data is not available for a specific zone, the dynamic shape should not be placed within that space. Upon clicking on the link, the user will navigate to the specific equipment for that zone. All detail pages will utilize the template graphics for terminal units as discussed earlier in this document.

3.3 FINAL ADJUSTMENTS

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.

3.4 POINTS LIST

A. Refer to the Mechanical Drawings.

3.5 SEQUENCE OF OPERATIONS

A. Refer to the Mechanical Drawings.

SECTION 26 05 00 - 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 details, notes or 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 Architect," "requested by the Architect," etc. However, no such implied meaning will be interpreted to extend the Architect'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 Architect'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 Architect's responsibilities and duties as specified in the General and Supplementary Conditions. In no case will "approval" by the Architect 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 (2020).

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 bidder 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.

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. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch (1 mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4 inch (6 mm) grommets in corners for mounting.

H. 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 square 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. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2 inch (38 mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports. Support wires shall be dedicated to the support of electrical materials and equipment. Ceiling support equipment and wires are not to be used for the support of electrical equipment. Identify electrical support wires as required by 2011 NFPA 70 300.11(A)(2).

H. 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.

I. Install metal channel racks for mounting cabinets, panelboards, 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.

J. Install sleeves for raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies.

K. 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. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts. 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. 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. 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.

E. 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.

F. 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.

G. 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.

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 furnished as a part of this contract, including those furnished under other Divisions. Provide all required disconnecting means, boxes, conduit, conductors, etc. Motors and equipment furnished under other Divisions will be installed under that Division.

B. Motor starters will be furnished under the division that the motors being controlled are furnished, and will be installed under Division 26 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 in Division 23.

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. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

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

E. Remove demolished material from project site.

F. 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 using agency. The using agency 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.

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

SECTION 26 05 19 - 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 those products 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 (2020).

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers:

1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Senator Wire & Cable Company.
4. Southwire Company.

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

C. Conductor Material: Copper complying with NEMA WC 5 or 7; stranded or solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

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

2.2 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.
6. Ideal

B. 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 or XHHW 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. Fire Alarm Circuits: Type THHN-THWN, in raceway or Power-limited, fire-protective, signaling circuit cable in raceways. Size as recommended by equipment manufacturer or as specified in fire alarm specifications.

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

D. 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 26 Section, "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 6 inches (150 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

SECTION 26 05 26 - 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 grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 SUBMITTALS

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

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

C. Field Test Reports: Submit written test reports to include 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.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 (2005), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

2. Comply with NFPA 70 (2020).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Grounding Conductors, Cables, Connections, and Rods:
   a. Ideal Industries, Inc.
   b. ILSCO
   c. Kearney/Cooper Power Systems
   d. O-Z/Gedney Co.; a business of the EGS Electrical Group
   e. Raco, Inc.; Division of Hubbell
   f. Thomas and Betts, Electrical

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section, "Conductors and Cables."

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

E. Bare Copper Conductors: Comply with the following:

   1. Solid Conductors: ASTM B 3.

   2. Stranded Conductors: ASTM B8.

2.3 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.

PART 3 - EXECUTION

3.1 APPLICATION

A. In raceways, use insulated equipment grounding conductors.

B. Equipment Grounding Conductor Terminations: Use bolted clamp type or compression connectors for conductors larger than 10 AWG. Use Plastic body twist-on connectors for 10AWG and smaller.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

3.3 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

C. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

D. Tighten screws and bolts for grounding and bonding 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.

E. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

END OF SECTION

SECTION 26 05 33 - 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:

1. Division 26 Section, "Basic Electrical Materials and Methods," for supports, anchors, and identification products.
2. Division 26 Section, "Wiring Devices," for devices installed in boxes.

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 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 (2020).

1.6 COORDINATION

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

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING AND RACEWAY SYSTEMS

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. EMT and Fittings: ANSI C80.3. U.L. 797.

1. Fittings, 2 Inch Diameter and Larger: Steel (not die cast) set-screw or compression type.
2. Fittings, Smaller than 2 Inches Diameter: Compression type.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.

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

2.2 METAL WIREWAYS

A. Manufacturers:

1. Hoffman.
2. Square D.

B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1 3R.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Screw-cover type.

F. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

1. Manufacturers:

a. Airey-Thompson Sentinel Lighting; Wiremold Company (The).
b. Thomas & Betts Corporation.
c. Walker Systems, Inc.; Wiremold Company (The).
d. Wiremold Company (The); Electrical Sales Division.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Hubbell, Inc.; Killark Electric Manufacturing Co.
2. O-Z/Gedney; Unit of General Signal.
3. RACO; Division of Hubbell, Inc.
4. Scott Fetzer Co.; Adalet-PLM Division.
5. Spring City Electrical Manufacturing Co.
6. Thomas & Betts Corporation.
7. 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.

2.5 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Use the following raceways for outdoor installations:

1. Exposed: IMC.

2. Concealed: IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment: LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. 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. Exposed in finished areas: Surface metal raceway where concealment is impossible. Limit use to the least possible. The impossibility of concealment is in the opinion of the Engineer.
3. Concealed: EMT.
4. Connection to Vibrating Equipment: FMC; except in wet or damp locations, use LFMC.
5. Damp or Wet Locations: IMC.
6. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

C. Minimum Raceway Size: 1/2-inch trade size (DN 14) unless noted.

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

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

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 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 26 Section, "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. Conceal raceways within finished walls, ceilings, and floors unless concealment is impossible or where otherwise indicated.

1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

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

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

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

1. Use insulating bushings to protect conductors.

J. Tighten set screws of threadless fittings with suitable tools.

K. Terminations:

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

L. 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.

M. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

3.4 CLEANING

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

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Transient voltage suppression panelboards.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

1.4 SUBMITTALS

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

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

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

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

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

C. Qualification Data: For testing agency.

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

1. Test procedures used.

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

E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, 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 "Material and Equipment."

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 (2020).

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 degrees F (40 degrees C).
2. Altitude: Not exceeding 6600 feet (2000 meters).

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

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

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 Owner no fewer than seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's 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 MANUFACTURED UNITS

A. Enclosures: Flush- and surface-mounted cabinets as indicated. 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.
3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

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.
3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
4. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

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

2.2 PANELBOARD SHORT-CIRCUIT RATING

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

2.3 DISTRIBUTION PANELBOARDS

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

1. Cutler-Hammer: PRL5
2. General Electric: Spectra Series
3. Siemens: Sentron S4 or S5
4. Square-D: I-Line

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.

C. Main Overcurrent Protective Devices: Circuit breaker (where scheduled).

D. Branch Overcurrent Protective Devices:

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
3. Fused switches.

2.4 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; 200 percent capacity neutral bus and lugs.

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 UL 1449 Clamping Levels: 400 V, line to neutral and line to ground on 120/208 V 800 V, line to neutral and line to ground on 277/480 V systems.
5. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
6. 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.

2.5 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 SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

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. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Install overcurrent protective devices and controllers.

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 loads. 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.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 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 26 24 16

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes cartridge fuses rated 600 V and less for use in switches.

1.3 SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current-limiting characteristics.
3. Time-current curves, coordination charts and tables, and related data.
4. Fuse size for elevator feeders and elevator disconnect switches.

B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 1, include the following:

a. Let-through current curves for fuses with current-limiting characteristics.
b. Time-current curves, coordination charts and tables, and related data.
c. Ambient temperature adjustment information.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single manufacturer.

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

C. Comply with NEMA FU 1.

D. Comply with NFPA 70 (2020).

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 degrees F (5 degrees C) or more than 100 degrees F (38 degrees C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.7 EXTRA MATERIALS

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

1. Fuses: Quantity equal to one complete set of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Cooper Bussman, Inc.
2. Ferraz Shawmut, Inc.
3. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Motor Branch Circuits: Dual element, time delay, current limiting, Class RK5.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION

SECTION 26 43 13 – SURGE PROTECTIVE 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 surge protective device at exterior HVAC equipment containing hermetic compressors.

B. Related Sections include Division 26 Section, "Panelboards," for factory-installed TVSSs.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. SVR: Suppressed voltage rating.

C. TVSS: Transient voltage surge suppressor.

D. SPD: Surge Protective Devices (SPD's).

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.

B. Product Certificates: For SPD's, signed by product manufacturer certifying compliance with the following standards:

1. UL 1283.
2. UL 1449.

C. Operation and Maintenance Data: For SPD's to include in emergency, operation, and maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain SPD's and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of SPD's 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 LS 1, "Low Voltage Surge Protection Devices."

E. Comply with NFPA 70 (2020).

1.6 PROJECT CONDITIONS

A. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 120 degrees F (0 to 50 degrees C).
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet (6090 meters) above sea level.

1.7 COORDINATION

A. Coordinate location of SPD's to allow adequate clearances for maintenance.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within one year from date of Final Inspection.

PART 2 - PRODUCTS

2.1 SURGE PROTECTIVE DEVICES

A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:

1. LED indicator lights for power and protection status.
2. Knockout mounted.

B. Peak Single-Impulse Surge Current Rating: 20 kA per phase.

C. Connection Means: Permanently wired.

D. Manufacturers:

1. 120/208V, three phase

   a. Cutler Hammer 2-CHSA01
   b. General Electric 2-9L15FCB001
   c. Joslyn 1455-21
   d. Square-D 2-SDSA1175

2. 120/208V, single phase

   a. Cutler Hammer CHSA01
   b. General Electric 9L15FCB001
   c. Joslyn 1261-21
   d. Square-D SDSA1175

3. 277/480V, three phase

   a. Cutler Hammer CHSA03
   b. General Electric 9L15ECC001
   c. Joslyn 1456-21
   d. Square-D SDSA3650

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

A. Install devices at each exterior item of mechanical equipment having a hermetic compressor. Connect on line side of local disconnect, with ground lead bonded to branch circuit ground.

B. Make arrester leads as short as possible and keep radius of bends in wire as large as is practical.

3.2 PLACING SYSTEM INTO SERVICE

A. Do not energize or connect HVAC equipment to their sources until SPD's are installed and connected.

3.3 FIELD QUALITY CONTROL

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

1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
2. Complete startup checks according to manufacturer's written instructions.
3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.

B. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to maintain SPD's. Refer to Division 1.

END OF SECTION