

SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS

07/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 709 (2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2007; Errata 2007) National Electrical Safety Code

IEEE Std 100 (2000) The Authoritative Dictionary of IEEE Standards Terms

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA/NEIS 1 (2006) Standard for Good Workmanship in Electrical Contracting

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA Z535.4 (2007) Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2007; AMD 1 2008) National Electrical Code - 2008 Edition

NFPA 70E (2004) Electrical Safety in the Workplace

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Division 13, SPECIAL CONSTRUCTION, Divisions 22 and 23, PLUMBING and HEATING VENTILATING AND AIR CONDITIONING, Division 27, COMMUNICATIONS, and Division 28. This section applies to all sections of Division 26 and 33, ELECTRICAL and UTILITIES, of this project specification unless specified otherwise in the individual sections. This section has been incorporated into, and thus, does not apply to, and is not referenced in the following sections.

Section 26 05 48.00 10 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT
Section 26 08 00 APPARATUS INSPECTION AND TESTING
Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM

Section 26 23 00 SWITCHBOARDS AND SWITCHGEAR
Section 26 28 01.00 10 COORDINATED POWER SYSTEM PROTECTION
Section 26 29 23 VARIABLE FREQUENCY DRIVE SYSTEMS
Section 26 32 33.00 10 UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM
Section 26 41 00.00 40 FACILITY LIGHTNING PROTECTION
Section 26 43 00 TRANSIENT VOLTAGE SUPPRESSION
Section 26 51 00 INTERIOR LIGHTING
Section 26 56 00 EXTERIOR LIGHTING
Section 26 60 13 LOW-VOLTAGE MOTORS
Section 28 05 26.00 40 GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY
Section 28 31 74.00 20 INTERIOR FIRE DETECTION AND ALARM SYSTEM
Section 33 70 02.00 10 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in **IEEE Std 100**.
- b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.
- c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 12 kV primary, three phase, three wire, 60 Hz, and 480 volts secondary, three phase, four wire. Primary cable installation and connections to the power distribution system will be by others and the transformer service conductors to the main 480-Volt outdoor switchboard will be made by others. Contractor shall provide conduits only and shall install transformer slab/box, pullboxes, conduits and pull ropes as shown on the Drawings.

1.5 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.5.1 Shop Drawings (SD-02)

Include wiring diagrams and installation details of equipment, control panels, accessories, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. In addition, submit conduit Layout Drawings which include any circuit combining as allowed in Article 3.4.

1.5.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves as applicable.

1.6 ELECTRIC AND TELEPHONE SERVICE DIVISION OF RESPONSIBILITY

Incoming underground electrical service facilities provided by others is work provided outside this Contract. Under this Contract provide customer required service provisions and electrical work including, but not limited to, primary trench and backfill, primary duct system, transformer slab box site preparation, precast pullboxes, metering components and associated conduit, and secondary facilities. Schedule and coordinate work of others as required to provide electric service to the Work.

Incoming telephone service facilities provided by the serving utilities as part of their normal obligation to customers is work provided outside this Contract. Under this Contract provide customer required service provisions and electrical work.

Interior telecommunications central and station equipment (telephone instruments, telephone switches and hubs, servers, software, etc.) is work provided by others outside this Contract. Under this Contract provide raceways, outlet and junction boxes, cover plates, pull wires, cabling and as indicated.

1.7 QUALITY ASSURANCE

1.7.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of [NECA/NEIS 1](#), [NFPA 70](#) and [NFPA 70E](#) unless more stringent requirements are specified or indicated.

1.7.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories Inc. shall conform to those standards and shall have an applied UL listing mark or label

1.7.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable

if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.7.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.8 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.9 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

- a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
- b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- c. Safety precautions.
- d. The procedure in the event of equipment failure.
- e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.10 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.11 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, black with white center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal

block style.

1.12 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to **IEEE C2**, **NFPA 70**, **NFPA 70E**, and requirements specified herein.

1.13 INSTRUCTION TO PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

PART 2 PRODUCTS

2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of **NEMA 250** corrosion-resistance test and the additional requirements specified in the technical sections.

PART 3 EXECUTION

3.1 GENERAL

Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned. Contractor shall be responsible for actual location of equipment and devices and for proper routing and support of raceways, subject to approval of Engineer.

Check approximate locations of light fixtures, switches, electrical outlets, equipment, and other electrical system components shown on Drawings for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, notify Engineer in writing.

Install work in accordance with **NECA/NEIS 1**, unless otherwise specified.

Keep openings in boxes and equipment closed during construction.

Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully perform cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces

to original condition.

3.2 ENERGIZED ELECTRICAL QUALIFIED PERSONS

Install work on and near energized electrical equipment in accordance with NFPA 70E. Workers shall have the training and experience to be Qualified Persons, shall provide work permits when working on and near energized electrical equipment, and shall wear the proper Personnel Protective Equipment for the shock and arc flash hazards.

3.3 ANCHORING AND MOUNTING

Equipment anchoring and mounting shall be in accordance with manufacturer's requirements for seismic zone criteria given in Section 26 05 48.00 10, SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

3.4 COMBINING CIRCUITS INTO COMMON RACEWAY

Drawings show each homerun circuit to be provided. Do not combine power or control circuits into common raceways without authorization of Engineer. Contractor shall submit a detailed conduit and conductor schedule, including CAD Layout Drawings for review.

Homerun circuits shown on Drawings indicate functional wiring requirements for power and control circuits. Circuits shall be combined into common raceways in accordance with the following requirements:

- a. Analog control circuits from devices in same general area to same destination.
 1. No power or AC discrete control circuits shall be combined in same conduit with analog circuits.
 2. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, paging system circuits shall be combined with power or Class 1 circuits.
 3. Analog circuits shall be continuous from source to destination. Do not add terminal junction box, splice, or combine into a multi-pair cable without authorization of Engineer.
 4. Raceways shall be sized per General Circuit and Raceway Schedule or as shown and do not exceed NEC fill.
 5. Changes shall be documented on record drawings.
- b. Discrete control circuits from devices in the same general area to the same destination.
 1. No power or analog control circuits shall be combined in same conduit with discrete circuits.
 2. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, and paging system circuits shall be combined with power or Class 1 circuits.
 3. Raceways shall be sized per the General Circuit and Raceway Schedule or as shown and do not exceed NEC fill.

4. Changes shall be documented on record drawings.

c. Power circuits from loads in same general area to same source location (such as: panelboard, switchboard, low voltage motor control center).

1. Lighting Circuits: Combine no more than three circuits to a single raceway. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.

2. Receptacle Circuits, 120-Volt Only: Combine no more than three circuits to a single raceway. Provide a separate neutral conductor for each circuit. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.

3. All Other Power Circuits: Do not combine power circuits without authorization of Engineer.

4. Changes shall be documented on record drawings.

3.5 NAMEPLATES, SIGNS, AND LABELS

3.5.1 Arc Flash Protection Warning Signs:

a. Field mark switchboards, motor control centers, panelboards and other equipment required to be labeled to warn qualified persons of potential arc-flash hazards. Locate marking so to be clearly visible to persons before working on energized equipment.

b. Use arc flash hazard boundary, energy level, PPE level and description, shock hazard, bolted fault current, and equipment name from study required in Section 26 28 01.00 10, COORDINATED POWER SYSTEM PROTECTION as basis for the warning signs.

3.5.2 Equipment Nameplates:

a. Provide a nameplate to label electrical equipment including switchgear, switchboards, motor control centers, panelboards, motor starters, transformers, terminal junction boxes, disconnect switches, switches and control stations.

b. Switchgear, motor control center, transformer, and terminal junction box nameplates shall include equipment designation.

c. Disconnect switch, starter, and control station nameplates shall include name and number of equipment powered or controlled by that device.

d. Switchboard and panelboard nameplates shall include equipment designation, service voltage, and phases.

e. Conduits shall be tagged with brass or stainless steel stamped discs, and wires at least 1-inch in diameter. Inscription shall be per Circuit and Raceway Schedule provided by the Contractor. Tags shall be applied at termination points.

3.5.3 LOAD BALANCE

a. Drawings and Specifications indicate circuiting to electrical loads

and distribution equipment.

b. Balance electrical load between phases as nearly as possible on switchboards, panelboards, motor control centers, and other equipment where balancing is required.

c. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

3.5.4 CLEANING AND TOUCHUP PAINTING

a. Cleaning: Throughout the Work, clean interior and exterior of devices and equipment by removing debris and vacuuming.

b. Touchup Paint:

1. Touchup scratches, scrapes and chips on exterior and interior surfaces of devices and equipment with finish matching type, color, and consistency and type of surface of original finish.

2. If extensive damage is done to equipment paint surfaces, refinish entire equipment in a manner that provides a finish equal to or better than factory finish, that meets requirements of Specification, and is acceptable to Engineer.

3.5.5 PROTECTION FOLLOWING INSTALLATION

a. Protect materials and equipment from corrosion, physical damage, and effects of moisture on insulation and contact surfaces.

b. When equipment intended for indoor installation is installed at Contractor's convenience in areas where subject to dampness, moisture, dirt or other adverse atmosphere until completion of construction, ensure adequate protection from these atmospheres is provided and acceptable to Engineer.

3.6 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00.00 40 PAINTING AND COATING.

3.7 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two stainless steel screws or two rivets.

3.8 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart. Signs shall meet requirements of NEMA Z535.4 in each location and service where applied.

-- End of Section --