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USACE / NAVFAC / AFCEA UFGS-16050N (August 2004)  
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Preparing Activity: NAVFAC Superseding  
UFGS-16050N (February 2003)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL date 22 December 2004

Revised throughout-changes not indicated by CHG tags

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08/04

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### SECTION 16050N

#### BASIC ELECTRICAL MATERIALS AND METHODS 08/04

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NOTE: This guide specification covers electrical  
general requirements, complete.

Comments and suggestion on this specification are  
welcome and should be directed to the technical  
proponent of the specification. A listing of the  
technical proponents, including their organization  
designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as  
a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer  
choices or locations where text must be supplied by  
the designer.

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NOTE: The following information shall be shown on  
the project drawings:

1. Extent and location of work to be accomplished.
2. Wiring, equipment, and accessories necessary for  
a complete installation.

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## 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) Laminated Thermosetting Materials

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

TIA/EIA-606-A (2002) Administration Standard for the  
Telecommunications Infrastructure  
(ANSI/TIA/EIA-606-A)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2002) National Electrical Safety Code

IEEE Std 100 (2000) IEEE Standard Dictionary of  
Electrical and Electronics Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2003) Enclosures for Electrical Equipment  
(1000 Volts Maximum)

NEMA C57.12.28 (1999) Pad-Mounted Equipment - Enclosure  
Integrity

NEMA C57.12.29 (1999; E 2000) Pad-Mounted Equipment -  
Enclosure Integrity for Coastal  
Environments

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2005) National Electrical Code

1.2 RELATED REQUIREMENTS

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NOTE: To apply this guide specification to other divisions of the project specification, insert the appropriate division number and title to read such as: Division 11, "Equipment"; Division 13, "Special Construction"; Division 14, "Conveying Systems"; and Division 15, "Mechanical." Ensure that the appropriate sections having electrical equipment include the following paragraph:

"1.X RELATED REQUIREMENTS: Section 16050, "Basic Electrical Materials and Methods," applies to this section, with the additions and modifications specified herein."

Delete sections in the last paragraph that are not in the job. The requirements of this specification section are being incorporated into the other specification sections that reference it with the intent of phasing out this section. As the requirements of this section are incorporated into each specification section, that section should be added to the list in the last paragraph below.

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This section applies to certain sections of [ Division 2, "Site Construction," ] [ Division 11, "Equipment," ] [ Division 13, "Special Construction," ] [ and ] [ Division 14, "Conveying Systems" ] [ and ] [ Division 15, "Mechanical" ]. This section applies to all sections of Division 16, "Electrical," 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 16272 THREE-PHASE PAD MOUNTED TRANSFORMERS  
Section 16273 SINGLE-PHASE PAD MOUNTED TRANSFORMERS  
Section 16360 SECONDARY UNIT SUBSTATIONS  
Section 16402 ELECTRICAL DISTRIBUTION SYSTEM  
Section 16442 SWITCHBOARDS AND SWITCHGEAR  
Section 16510 INTERIOR LIGHTING  
Section 16520 EXTERIOR LIGHTING  
Section 16710 BUILDING TELECOMMUNICATIONS CABLING SYSTEM  
Section 16711 TELECOMMUNICATIONS OUTSIDE PLANT

### 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

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NOTE: Delete this paragraph for SOUTHNAVFACENGCOM projects. Use IEEE C57.12.00 designations, such as 4160 V and 480Y/277 V, when referring to the primary and secondary voltages, respectively, in the following paragraph.  
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Electrical characteristics for this project shall be [\_\_\_\_\_] kV primary, [single] [three] phase, [two] [three] [four] wire, [60] [50] [\_\_\_\_\_] Hz, and [\_\_\_\_\_] volts secondary, [single] [three] phase, [three] [four] wire. Final connections to the power distribution system at the existing [substation] [manhole] [\_\_\_\_\_] shall be made by the [Contractor as directed by the Contracting Officer] [Government].

### 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 indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, 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.

#### 1.5.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

### 1.6 QUALITY ASSURANCE

#### 1.6.1 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 NFPA 70 unless more stringent requirements are specified or indicated.

#### 1.6.2 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 commercial or 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.

##### 1.6.2.1 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.

##### 1.6.2.2 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.

### 1.7 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.

#### 1.8 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.

#### 1.9 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.

#### 1.10 FIELD FABRICATED NAMEPLATES

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**NOTE: Use the following paragraph where nameplates  
are fabricated to identify specific equipment  
designated on the drawings.**  
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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, 3 mm (0.125 inch) 0.125 inch thick, white with [black] [\_\_\_\_\_] 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 25 by 65 mm (one by 2.5 inches) one by 2.5 inches. Lettering shall be a minimum of 6.35 mm (0.25 inch) 0.25 inch high normal block style.

#### 1.11 WARNING SIGNS

Provide warning signs for the enclosures of electrical equipment including substations, pad-mounted transformers, pad-mounted switches, generators, and switchgear having a nominal rating exceeding 600 volts.

- a. When the enclosure integrity of such equipment is specified to be in accordance with NEMA C57.12.28 or NEMA C57.12.29, such as for pad-mounted transformers[ and pad-mounted SF6 switches], provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of 178 by 255 mm (7 by 10 inches) 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal 50 mm (2 inch) 2 inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background. Decal shall be Panduit No. PPS0710D72 or approved equal.
- [b. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 355 by 255 mm (14 by 10 inches) 14 by 10 inches with the legend "DANGER HIGH VOLTAGE KEEP OUT" printed in three lines of nominal 75 mm (3 inch) 3 inch high white letters on a red and black field.]

#### 1.12 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS

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**NOTE: Verify cable labeling requirements with the  
local Activity. Provide lead cable tags only when  
specifically required by the Activity.**  
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Provide tags for each power and telecommunications cable or wire located in manholes, handholes, and vaults. The tags shall be polyethylene[ or sheet lead]. Do not provide handwritten letters. [The first position on the power cable tag shall denote the voltage. The second through [sixth] [\_\_\_\_\_] positions on the tag shall identify the circuit. [The next to last position shall denote the phase of the circuit and shall include the Greek "phi" symbol.] The last position shall denote the cable size.] As an example, a tag could have the following designation: "11.5 NAS 1-8(Phase A)500," denoting that the tagged cable is on the 11.5kV system circuit number NAS 1-8, underground, Phase A, sized at 500 kcmil. The labeling of telecommunications cable tags shall comply with TIA/EIA-606-A. [Tag legend shall be as indicated.]

##### 1.12.1 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 22.4 MPa (3250 pounds per square inch) 3250 pounds per square inch; and that are two millimeter (0.08 inch) 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 77 degrees C 170 degrees F. Provide 1.3 mm (0.05 inch) 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties shall have a minimum loop tensile strength of 778.75 N (175 pounds) 175 pounds. The cable tags shall have black block letters, numbers, and symbols 25 mm (one inch) one inch high on a yellow background. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.

##### [1.12.2 Lead Cable Tags

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**NOTE: Provide lead cable tags only when specifically**



required by the Activity.

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Provide tags of virgin sheet lead, one-piece wraparound strap type, slotted on one end for attaching the strap. Minimum size of tags shall be 25 mm wide by 1.2 mm (one inch wide by 3/64 inch) one inch wide by 3/64 inch thick and a length sufficient for die stamping the identification on one line and banding around the cable or wire, but not less than 255 mm (10 inches) 10 inches long. Tags shall be die stamped with numbers, letters, and symbols not less than 6.35 mm (0.25 inch) 0.25 inch high and approximately 0.38 mm (0.015 inch) 0.015 inch deep in normal block style.

]1.13 ELECTRICAL REQUIREMENTS

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

1.14 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government 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

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NOTE: This paragraph covers only the basic painting requirements for most electrical equipment. Include in the section specifying the equipment any special finishes for high or low temperatures and corrosive atmospheres. Retain the bracketed statement when switchgear and other equipment having specific paint requirements are specified.

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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 FIELD APPLIED PAINTING

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NOTE: Use and coordinate paint and coating requirements with Section 09900, PAINTS AND COATINGS when provided in the job. Use the second bracketed option when Section 09900 is not provided or when requirements are beyond what is specified in Section 09900.

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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 09900 PAINTS AND COATINGS] [the section specifying the associated electrical equipment].

### 3.2 FIELD FABRICATED NAMEPLATE MOUNTING

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

### 3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 9 meters (30 feet) 30 feet apart.

### 3.4 CABLE TAG INSTALLATION

Install cable tags in each manhole, handhole, and vault as specified, including each splice. [Tag only new wire and cable provided by this contract.] [Tag new wire and cable provided under this contract and existing wire and cable which are indicated to have splices and terminations provided by this contract.] Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.

-- End of Section --