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USACE / NAVFAC / AFCEC / NASA UFGS-33 77 19.00 40 (August 2013)  
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Preparing Activity: NASA Superseding  
UFGS-33 77 19.00 40 (August 2010)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2016

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08/13

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### SECTION 33 77 19.00 40

#### MEDIUM-VOLTAGE GAS SWITCH 08/13

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NOTE: This guide specification covers the requirements for the requirements for 5k through 38 kV, 600A load-break sulphur hexafluoride (SF6) gas switches. On drawings, indicate subsurface, vault, pad-mount, indoor, metal-enclosed, or pole mounted type; the number of switched ways; separable connections; and single-side, double-side, floor, wall, ceiling, or other type installation.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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## PART 1 GENERAL

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NOTE: If Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS is not included in the project specification, insert applicable requirements therefrom and delete the following paragraph.

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Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, and Section 26 05 70.00 40 HIGH VOLTAGE OVERCURRENT PROTECTIVE DEVICES and Section 26 05 71.00 40 LOW VOLTAGE OVERCURRENT PROTECTIVE DEVICES apply to work specified in this section.

## 1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text are automatically deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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

### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

|             |   |
|-------------|---|
| ANSI C37.72 | (1987) Standard for Manually-Operated Dead-Front Pad Mounted Switchgear with Load Interrupting Switches and Separable Connections for Alternating-Current Systems |
|-------------|---|

### ASTM INTERNATIONAL (ASTM)

|                 |   |
|-----------------|---|
| ASTM A123/A123M | (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM A153/A153M | (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware             |
| ASTM D2472      | (2000; R 2014) Standard Specification for Sulphur Hexafluoride                                  |

### INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

|                |   |
|----------------|---|
| IEEE 386       | (2006; INT 1 2011) Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V |
| IEEE C57.12.28 | (2014) Standard for Pad-Mounted Equipment - Enclosure Integrity   |

### NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

|             |   |
|-------------|---|
| RCBEA GUIDE | (2004) NASA Reliability Centered Building |
|-------------|---|

## 1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, use a code of up to three characters within the submittal tags following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

An "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that reviews the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Connection Diagrams[; G[, [\_\_\_\_]]]

Load- Break Switches[; G[, [\_\_\_\_]]]

### SD-03 Product Data

SF6 Load-Break Switches[; G[, [\_\_\_\_]]]

Space Heaters[; G[, [\_\_\_\_]]]

Mounting Frames[; G[, [\_\_\_\_]]]

Accessories[; G[, [\_\_\_\_]]]

#### SD-06 Test Reports

Basic Impulse Insulation Level (BIL)[; G[, [\_\_\_\_]]]

Withstand Voltage Rating[; G[, [\_\_\_\_]]]

Momentary RMS Asymmetrical Rating[; G[, [\_\_\_\_]]]

Leak Tests[; G[, [\_\_\_\_]]]

Final Test Reports[; G[, [\_\_\_\_]]]

#### SD-10 Operation and Maintenance Data

Switches[; G[, [\_\_\_\_]]]

Space Heaters[; G[, [\_\_\_\_]]]

### 1.3 PREDICTIVE TESTING AND INSPECTION TECHNOLOGY REQUIREMENTS

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**NOTE: The Predictive Testing and Inspection (PT&I) tests prescribed in Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS are MANDATORY for all [NASA] [\_\_\_\_] assets and systems identified as Critical, Configured, or Mission Essential. If the system is non-critical, non-configured, and not mission essential, use sound engineering discretion to assess the value of adding these additional test and acceptance requirements. See Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS for additional information regarding cost feasibility of PT&I.**

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This section contains systems and/or equipment components regulated by NASA's Reliability Centered Building and Equipment Acceptance Program. This program requires the use of Predictive Testing and Inspection (PT&I) technologies in conformance with RCBEA GUIDE to ensure building equipment and systems have been installed properly and contain no identifiable defects that shorten the design life of a system and/or its components. Satisfactory completion of all acceptance requirements is required to obtain Government approval and acceptance of the work.

Perform PT&I tests and provide submittals as specified in Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS.

### 1.4 MAINTENANCE MATERIALS SUBMITTALS

Submit operation and maintenance manuals for switches, and space heaters.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT

#### 2.1.1 Switches

Provide detail drawings that show mounting details and configuration for load-break switches.

Provide gas insulated load-break switches of the [subsurface] [pad-mounted] [vault] [\_\_\_\_\_] type in accordance with ANSI C37.72 and IEEE 386.

Provide sulphur hexafluoride (SF6) gas in accordance with ASTM D2472.

Provide manually operated, load-interrupting type SF6 load-break switches, rated [15] [\_\_\_\_\_] kV [600] [\_\_\_\_\_] amperes, minimum, continuous and load break for operation on a [12.47] [\_\_\_\_\_] kV, 3-phase, 3-wire system.

Provide switch enclosures in accordance with IEEE C57.12.28 equipped with ground bus capable of carrying the rated fault current for one second for each way.

Provide each switch with pressure gage, position viewing window and fill plug.

Provide lockable incoming line position of switches to prevent unauthorized grounding.

Provide cable and cable terminations in accordance with Section 26 05 13.00 40 MEDIUM-VOLTAGE CABLES. Equip switches with 600 amperes and bushings with inserts to accept load break elbows, as indicated.

Provide cable terminations from the fuse compartment that are preformed stress-cones or have deep-well apparatus bushings in accordance with IEEE 386.

Provide provisions for padlocking each handle in any position.

Provide switch tanks that are constructed of stainless steel plate, fully TTG welded.

Provide operating mechanisms that are equipped with handles for manual operation and are operated by a non-teasible, snap-action, quick-make, quick-break. Make opening and closing of the main contacts totally independent of the speed or position of the operating handle. Secure operating handle to the shaft in a manner that ensures tightness and alignment.

#### 2.1.2 Space Heaters

Permanently mark connection diagrams for heater connections on drawings and shipping covers.

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**NOTE: Space heaters are seldom required with SF6 switches. Choose the following paragraphs only when metal enclosed SF6 switch/fuse modules are used and where moisture could condense on components in**

air-filled compartments.

Wattage supplied by heaters is one-fourth of the heater nameplate rating when 240-volt heaters are operated at 120 volts.

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Equip ventilated cable termination compartment and the fuse compartment on outdoor switches with externally energized space heaters to provide approximately [40] [\_\_\_\_\_] watts/square meter [4] [\_\_\_\_\_] watts/square foot of outer surface area. Provide heaters that have a power density that does not exceed [4] [\_\_\_\_\_] watts per 650 square millimeter [4] [\_\_\_\_\_] watts per square inch of heater element surface. Provide heaters that are rated at [240] [\_\_\_\_\_] volts for connection at [120] [\_\_\_\_\_] volts. Locate heaters at the lowest portion of each space to be heated. Cover terminals. Use thermostats to regulate the temperature.

Provide installed and operable heaters at the time of shipment so that the heaters can be operated immediately on arrival at the site, during storage, or before installation. Mark connection locations prominently on drawings and shipping covers with temporary leads for storage operation easily accessible without removal of shipping protection.

### 2.1.3 Mounting Frames

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**NOTE:** Choose the following paragraphs when pad-mounted switches are used. Subsurface switches do not require frames since they mount directly to the floor, walls, or ceiling.

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Furnish mounting frames that are of angle-iron construction, for all [pad] [\_\_\_\_\_] -mounted switches and are hot-dipped galvanized after fabrication in accordance with [ASTM A123/A123M] [ASTM A153/A153M].

After fabrication, clean and paint all exposed ferrous metal surfaces of the pad mount enclosure.

Paint mounting frames in accordance with ANSI C37.72.

## 2.2 ACCESSORIES

Provide fittings, lifting eyes, insulators, and other required accessories with the switch as necessary.

Provide all corrosion-resistant metal operating parts of switch assemblies.

Provide switches with suitable attachments to permit closing and opening under full rated load current, without damage.

Provide fuses located in a separate compartment on the outgoing feeders as indicated and per Section 26 05 70.00 40 HIGH VOLTAGE OVERCURRENT PROTECTIVE DEVICES and Section 26 05 71.00 40 LOW VOLTAGE OVERCURRENT PROTECTIVE DEVICES. Interlock fuse-compartment doors with switch mechanisms.

Provide switches with a visible break option that allows direct viewing of the switch contacts in the open and closed positions within the switch tank.

## 2.3 FACTORY FINISH

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NOTE: For all outdoor applications and all indoor applications in a harsh environment refer to Section 09 96 00 HIGH-PERFORMANCE COATINGS. High performance coatings are specified for all outdoor applications because ultraviolet radiation breaks down most standard coatings, causing a phenomena known as chalking, which is the first stage of the corrosion process. For additional information contact The Coatings Industry Alliance, specific suppliers such as Keeler and Long and PPG, and NACE International (NACE).

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Provide switches with the manufacturer's standard paint finish when used for most indoor installations. For harsh indoor environments (any area subjected to chemical and/or abrasive action), and all outdoor installations, refer to Section 09 96 00 HIGH-PERFORMANCE COATINGS.

## 2.4 TESTS INSPECTIONS, AND VERIFICATIONS

### 2.4.1 Factory Information

Ensure switch has momentary rms asymmetrical rating of [22.5] [\_\_\_\_\_] kA and a close rms symmetrical rating of [12.5] [\_\_\_\_\_] kA for [1 minute] [\_\_\_\_\_] 60 Hz withstand voltage rating of [35] [\_\_\_\_\_] kV and basic impulse insulation level (BIL) of [95] [\_\_\_\_\_] kV. Provide the type of switch indicated, designed to show the internal wiring, indicating each switch position. Provide each switching way with [600A dead break] [200A deep well] bushings.

Provide test reports for the momentary rms asymmetrical rating, withstand voltage rating, basic impulse insulation level (BIL) in accordance with ANSI C37.72.

### 2.4.2 Shipping

Prior to shipment, ensure leak tests are performed and submit certification the completed switch assembly has a leak rate less than 0.0000001 cubic centimeters per second by a helium mass spectrometer test. Seal and fill switches with SF6 to a nominal 70 kilopascal 10 psig positive pressure at 24 degrees C 75 degrees F.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install switches in accordance with the manufacturer's instructions. Include in the installation all necessary hardware, insulators, and connections to line wire or bus.

#### 3.1.1 Coordination

Coordinate power fuses with the circuit breaker settings in the substation and with the transformer rating. Provide time-current characteristics, minimum melt and total clear times as required.



### 3.1.2 Grounding

Solidly bond tanks, mounting frames, and operating mechanisms to the station ground counterpoise in accordance with ANSI C37.72 and Section 28 05 26.00 40 GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY.

Identify incoming line position with a warning tag that states "CAUTION: INCOMING LINE, DO NOT GROUND."

### 3.2 FIELD TESTING

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NOTE: If the specified system is identified as critical, configured, or mission essential, use Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS to establish predictive and acceptance testing criteria, above and beyond that listed below.  
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Perform PT&I tests and provide submittals as specified in Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS.

Disconnect load break switch assembly from the power supply and feeder cables and ground the switch enclosure before conducting insulation and high-voltage tests.

Give load break switch assembly an insulation-resistance test with a 5000V insulation-resistance test set.

Apply all tests for not less than 5 minutes and until three equal consecutive readings one minute apart are obtained. Record readings every 30 seconds during the first 2 minutes and every minute thereafter. Minimum acceptable resistance readings are 100 megohms.

Upon satisfactory completion of the insulation-resistance test, subject the load break switch to a high-voltage, 60-Hz withstand test. Make test voltage equal to 75 percent of the factory test values and apply for one minute.

Upon satisfactory completion of the high-voltage, 60-Hz withstand test, give the switch assembly a second insulation-resistance test as before. Provide results of the second insulation-resistance test that are within 5 percent of the first test values and that indicate no evidence of permanent injury by the high potential test.

Operate switch assembly in the presence of the Contracting Officer. Provide final test reports to the Contracting Officer. Provide a cover letter/sheet with the reports clearly marked with the System Name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --