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Preparing Activity: NASA Superseding  
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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 18 July 2006

Latest change indicated by CHG tags

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### SECTION 33 77 19.00 40

#### GAS MEDIUM-VOLTAGE CIRCUIT BREAKER 06/06

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This guide specification covers the requirements for 5k through 38 kV, 600A load-break sulphur hexafluoride (SF6) gas switches. Drawings should 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.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of 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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## PART 1    GENERAL

### 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 will automatically be 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
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ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
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ASTM A 153/A 153M	(2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
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ASTM D 2472	(2000) Standard Specification for Sulphur Hexafluoride
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INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386	(1995) Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V
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IEEE C37.71	(2001) Standard for Three-Phase, Manually Operated Subsurface Load-Interrupting Switches for Alternating-Current Systems
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IEEE C57.12.28	(2005) Standard for Pad-Mounted Equipment - Enclosure Integrity
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1.2 GENERAL REQUIREMENTS

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NOTE: If Section 26 00 00.00 40 ELECTRICAL is not included in the project specification, applicable

requirements therefrom should be inserted and the following paragraph deleted.

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Sections 26 00 00.00 40 ELECTRICAL and 26 05 73.00 40 OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY apply to work specified in this section.

Connection Diagrams for heater connections shall be marked permanently on drawings and shipping covers.

### 1.3 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. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used 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.

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 will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Connection Diagrams for heater connections shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

Detail drawings shall show mounting details and configuration for the following:

#### Load- Break Switches

#### SD-03 Product Data

Equipment and performance data shall be provided for the following items:

SF6 Load-Break Switches  
Space Heaters  
Mounting Frames  
Accessories

#### SD-06 Test Reports

Test reports for the following shall be in accordance with [IEEE C37.71] and [ANSI C37.72].

Basic Impulse Insulation Level (BIL)  
Withstand Voltage Rating  
Momentary RMS Asymmetrical Rating  
Leak Tests

#### SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted for the following equipment:

Switches  
Space Heaters

### 1.4 SHIPPING

Prior to shipment, leak tests shall be performed and the completed switch assembly shall be certified to have leak rate less than 10<sup>-7</sup>cubic (.0000001)centimeters per second by a helium mass spectrometer test. Switches shall be sealed and filled with SF6 to a nominal 70 kilopascal 10 psig positive pressure at 24 degrees C 75 degrees F.

## PART 2 PRODUCTS

### 2.1 SWITCHES

Gas insulated load-break switches shall be of the [subsurface] [pad-mounted] [vault] [\_\_\_\_\_] type and shall be in accordance with [IEEE C37.71] [ANSI C37.72] and IEEE 386.

Sulphur hexafluoride (SF6) gas shall be in accordance with ASTM D 2472.

SF6 load-break switches shall be manually operated, load-interrupting type, load-break switches and shall be rated [15] [\_\_\_\_\_] kV [600] [\_\_\_\_\_] amperes, minimum, continuous and load break for operation on a [12.47] [\_\_\_\_\_] kV, 3-phase, 3-wire system. Switch shall have momentary rms asymmetrical rating of [22.5] [\_\_\_\_\_] kA and 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.

kV. Switches shall be the type indicated and shall be designed to show the internal wiring, indicating each switch position. Each switching way shall be provided with [600A dead break] [200A deep well] bushings.

Switch enclosures shall be in accordance with IEEE C57.12.28 and shall be equipped with ground bus capable of carrying the rated fault current for one second for each way.

Each switch shall have pressure gage, position viewing window and fill plug.

Incoming line position of switches shall be lockable to prevent unauthorized grounding.

Cable and cable terminations shall be in accordance with Section 26 05 13.00 40 MEDIUM-VOLTAGE CABLES. Switches shall be equipped with 600 amperes and bushings shall have inserts to accept load break elbows, as indicated.

Cable terminations from the fuse compartment shall be preformed stress-cones or have deep-well apparatus bushings in accordance with IEEE 386.

Provisions for padlocking each handle in any position shall be provided.

Each switch tank shall be constructed of stainless steel plate, fully TTG welded.

Operating mechanism shall come equipped with handles for manual operation and shall be operated by a non-teasible, snap-action, quick-make, quick-break. Opening and closing of the main contacts shall be totally independent of the speed or position of the operating handle. Operating handle shall be secured to the shaft in a manner that will ensure tightness and alignment.

## 2.2 ACCESSORIES

Fittings, lifting eyes, insulators, and other required accessories shall be provided with the switch as necessary.

All operating parts of switch assemblies shall be of corrosion-resistant metals.

Switches shall be provided with suitable attachments to permit closing and opening under full rated load current, without damage.

Fuses located in a separate compartment shall be provided on the outgoing feeders as indicated and per Section 26 05 73.00 40 OVERCURRENT PROTECTIVE DEVICES. Fuse-compartment doors shall be interlocked with switch mechanisms.

Switches shall be provided 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 SPACE HEATERS

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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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Ventilated cable termination compartment and the fuse compartment on outdoor switches shall be equipped with externally energized space heaters to provide approximately [40] [ ] watts/square meter [4] [ ] watts/square foot of outer surface area. Heaters shall be such that the power density does not exceed [4] [ ] watts per 650 square millimeter [4] [ ] watts per square inch of heater element surface. Heaters shall be rated at [240] [ ] volts for connection at [120] [ ] volts. Heaters shall be located at the lowest portion of each space to be heated. Terminals shall be covered. Thermostats shall be used to regulate the temperature.

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

## 2.4 COORDINATION

Power fuses shall be coordinated with the circuit breaker settings in the substation and with the transformer rating. Time-current characteristics, minimum melt and total clear times shall be as required.

## 2.5 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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Mounting frames of angle-iron construction, shall be furnished for all [pad] [ ] -mounted switches and shall be hot-dipped galvanized after fabrication in accordance with [ASTM A 123/A 123M] [ASTM A 153/A 153M].

After fabrication, all exposed ferrous metal surfaces of the pad mount enclosure shall be cleaned and painted.

Mounting frames shall be painted in accordance with ANSI C37.72.

## 2.6 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 will break 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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Switches shall be provided 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.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Switches shall be installed in accordance with the manufacturer's instructions. Installation shall include all necessary hardware, insulators, and connections to line wire or bus.

#### 3.2 GROUNDING

Switch tanks, mounting frames, and operating mechanisms shall be solidly bonded to the station ground counterpoise in accordance with [IEEE C37.71] [ANSI C37.72] and Section 28 05 26.00 40 GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY.

Incoming line position shall have a warning tag that states "CAUTION: INCOMING LINE, DO NOT GROUND."

#### 3.3 FIELD TESTING

Load break switch assembly shall be disconnected from the power supply and feeder cables and the switch enclosure grounded before conducting insulation and high-voltage tests.

Load break switch assembly shall be given an insulation-resistance test with a 5000V insulation-resistance test set.

All tests shall be applied for not less than 5 minutes and until three equal consecutive readings one minute apart are obtained. Readings shall be recorded 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, the load break switch shall be subjected to a high-voltage, 60-Hz withstand test. Test voltage shall be equal to 75 percent of the factory test values and shall be applied for one minute.

Upon satisfactory completion of the high-voltage, 60-Hz withstand test, the switch assembly shall be given a second insulation-resistance test as before. Results of the second insulation-resistance test shall be within 5 percent of the first test values and shall indicate no evidence of permanent injury by the high potential test.

Switch assembly shall be operated in the presence of the Contracting

Officer. Final test reports shall be provided to the Contracting Officer. Reports shall have a cover letter/sheet 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 --