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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2010

SECTION 33 77 19.00 40

MEDIUM-VOLTAGE GAS SWITCH 08/10

NOTE: This 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.

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 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).

PART 1 GENERAL

1.1 REFERENCES

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.

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 A 123/A 123M (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153/A 153M (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM D 2472 (2000; R 2006) Standard Specification for Sulphur Hexafluoride

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386 (2006) Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V

IEEE C57.12.28 (2005) Standard for Pad-Mounted Equipment - Enclosure Integrity

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

RCBEA GUIDE (2004) NASA Reliability Centered Building and Equipment Acceptance Guide

1.2 GENERAL REQUIREMENTS

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.

Sections 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS and 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.

Permanently mark [Connection Diagrams](#) for heater connections on drawings and shipping covers.

1.3 SUBMITTALS

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. Keep submittals 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, 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.

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

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.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

[SD-02 Shop Drawings](#)

Submit [Connection Diagrams](#) for heater connections in accordance with paragraph entitled, "General Requirements," of this section.

Provide detail drawings that show mounting details and configuration for the following:

Load- Break Switches

SD-03 Product Data

Provide Equipment and performance data for the following items:

SF6 Load-Break Switches

Space Heaters

Mounting Frames

Accessories

SD-06 Test Reports

Provide Test reports for the following in accordance with
ANSI C37.72.

Basic Impulse Insulation Level (BIL)

Withstand Voltage Rating

Momentary RMS Asymmetrical Rating

Leak Tests

SD-10 Operation and Maintenance Data

Submit Operation and Maintenance Manuals for the following
equipment:

Switches

Space Heaters

1.4 SHIPPING

Prior to shipment, perform leak tests and certify the completed switch assembly to have leak rate less than 10⁻⁷cubic (.0000001) 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.

1.5 PREDICTIVE TESTING AND INSPECTION TECHNOLOGY REQUIREMENTS

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.

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 installed by the Contractor 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 Contractor's work.

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

PART 2 PRODUCTS

2.1 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 D 2472.

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 that 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 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.

2.2 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 SPACE HEATERS

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.

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.

2.4 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.

2.5 MOUNTING FRAMES

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.

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 A 123/A 123M] [ASTM A 153/A 153M].

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

Paint mounting frames in accordance with ANSI C37.72.

2.6 FACTORY FINISH

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).

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.

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.

3.2 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.

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

3.3 FIELD TESTING

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.

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 --