

SECTION 26 13 00.00 20

SF6/HIGH-FIREPOINT FLUIDS INSULATED PAD-MOUNTED SWITCHGEAR
08/11

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 within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

- ASTM A167 (1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- ASTM D1535 (2013) Specifying Color by the Munsell System
- ASTM D2472 (2000; R 2006) Standard Specification for Sulphur Hexafluoride
- ASTM D6871 (2003; R 2008) Standard Specification for Natural (Vegetable Oil) Ester Fluids Used in Electrical Apparatus

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 C2 (2012; Errata 2012; INT 1-4 2012; INT 5-7 2013) National Electrical Safety Code
- IEEE C37.74 (2003; Int 1 2004) Standard Requirements for Subsurface, Vault, and Pad-Mounted Load-Interrupter Switchgear and Fused Load-Interrupter Switchgear for Alternating Current Systems Up to 38 kV
- IEEE C57.12.29 (2005) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

- NETA ATS (2013) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

- IEC 61099 (2010; ED 2.0) Insulating Liquids -

Specifications for Unused Synthetic
Organic Esters for Electrical Purposes

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3 2014) National Electrical Code

NFPA 70B (2013) Recommended Practice for Electrical Equipment Maintenance

UNDERWRITERS LABORATORIES (UL)

UL 467 (2007) Grounding and Bonding Equipment

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA-STD-019e (December 22, 2005) Lightning and Surge Protection, Grounding, Bonding and Shielding requirements for Facilities and Electronic Equipment

1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS and Section 26 08 00 APPARATUS INSPECTION AND TESTING, apply to this section, with the additions and modifications specified herein.

1.3 DEFINITIONS

1.3.1 Switched Way

A switched way is considered a three-phase circuit entrance to the bus through a switch. For single-phase switches, it is a single-phase entrance to the bus through a switch.

1.4 SUBMITTALS

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. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Switchgear Drawings; G

SD-03 Product Data

Each submittal shall include data on switches and associated accessories. Each submittal shall include manufacturer's information for each component, device and accessory provided with the equipment.

SF6/High-Firepoint Fluid Insulated Pad-mounted Switchgear; G

Insulated High-Voltage Connectors; G

Surge Arresters; G

SD-06 Test Reports

Acceptance Checks and Tests; G

SD-07 Certificates

Paint Coating System; G

SD-09 Manufacturer's Field Reports

Switchgear design and production tests; G

SD-10 Operation and Maintenance Data

SF6/High-Firepoint Fluid Insulated Pad-mounted Switchgear
Operation and Maintenance, Data Package 5; G

Submit in accordance with Section 01 78 23 OPERATION AND
MAINTENANCE DATA.

1.5 QUALITY ASSURANCE

1.5.1 Switchgear Drawings

Furnish drawings that include, but are not limited to, the following:

- a. Overall dimensions, weights, plan view, and front view
- b. Ratings
- c. Single-line diagram.

1.5.2 Paint Coating System

Submit IEEE C57.12.29 paint coating system performance requirement tests.

1.5.3 Electronic Overcurrent Control Curves

Provide time-current characteristic curves (in electronic format suitable for import into computer programs EasyPower and SKM PowerTools for Windows) and instruction manuals for the electronic overcurrent control.

1.6 MAINTENANCE

1.6.1 SF6/High-Firepoint Fluid Insulated Pad-mounted Switchgear Operation and Maintenance Data

Submit Operation and Maintenance Manuals in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

PART 2 PRODUCTS

2.1 SF6/HIGH-FIREPOINT FLUID INSULATED PAD-MOUNTED SWITCHGEAR

IEEE C37.74

2.1.1 Ratings and Test Requirements

The voltage rating of the switchgear shall be 15 kV. The corresponding ratings associated with the required switchgear voltage rating shall be as follows:

Rated Maximum Voltage, kV	15.5
Rated Withstand Impulse Voltage, kV BIL	95
Continuous and Load Interrupting Current, A	600
Short-Time Current, kA rms Sym	12.5
Short-Circuit interrupting Current, kA rms Sym	12.5

2.1.2 Switchgear Construction

Switch contacts and cable entrance terminations shall be contained in a sealed, dielectric-filled stainless steel tank. Switchgear shall be shipped factory filled with appropriate levels of SF6 gas conforming to ASTM D2472 or less-flammable, high-firepoint biodegradable fluid conforming to ASTM D6871 and IEC 61099. Switchgear shall be configured with load interrupting switched ways as indicated. Switchgear shall have front accessible terminations suitable for cables entering from below with the manual operating provisions either mounted on the rear or capable of hookstick operation. Switch contact positions for switched ways shall be visible through viewing windows in the switchgear tank located adjacent to the manual operating provisions. Provide internal gas pressure gage or fluid level gage in viewable location from switch operating handle. Each switched way shall have three position switch; Open, Closed, Ground and provisions for grounding.

2.1.2.1 Pad-mounting Provisions

Provide enclosed switchgear suitable for installation on a concrete pad. Switchgear support frame and its compartments shall be fabricated of ASTM A167 type 304 or 304L stainless steel painted green in accordance with ASTM D1535 Munsell 7GY3.29/1.5 green. Paint coating system shall comply with IEEE C57.12.29 regardless of equipment material. Paint enclosure including base.

2.1.3 Load Interrupting Switched Ways

Load interrupter switched ways shall provide three-pole group operated switching.

2.1.4 Low Voltage Test Pins

Load interrupting switch ways shall have internal load side voltage sensors and external test pins that allow for low voltage checks to confirm energized and in-phase conditions using a standard high-impedance voltmeter.

2.1.5 Dead-Front High-Voltage Bushings

IEEE 386. 15 kV, 95 kV BIL. Provide 600 ampere one-piece deadbreak apparatus bushings for each switched way.

- a. Parking stands: Provide a parking stand near each dead-front bushing.

2.2 Insulated High-Voltage Connectors

IEEE 386. Provide corresponding connector for each switched way. Connectors shall have a grounding eye and test point.

- a. 600 Ampere deadbreak connector ratings: Voltage: 15 kV, 95 BIL. Short time rating: 12,500, rms symmetrical amperes. Connectors shall have 200 ampere bushing interface for surge arresters.
- b. Provide one set of three 200A grounding elbows. Deliver grounding elbows to the Contracting Officer.

2.3 SF6 Refill Cylinders

Provide two SF6 refill cylinders, minimum size of 6 pounds of SF6; include regulator, valves, and hose for connection to the fill valve of the switch.

2.4 SOURCE QUALITY CONTROL

2.4.1 Switchgear Design and Production Tests

Furnish reports which include results of design and production tests performed according to **IEEE C37.74**. Production tests shall be performed by the manufacturer on each switchgear assembly to ensure that design performance is maintained in production.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to **IEEE C2**, **FAA-STD-019e**, **NFPA 70**, and to the requirements specified herein.

3.2 GROUNDING

NFPA 70, **FAA-STD-019e** and **IEEE C2**, except that grounds and grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms. When work, in addition to that indicated or specified, is directed to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section **33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION** at each corner of switchgear pad.

3.2.2 Switchgear Grounding

Connect #4/0 bare copper conductor ground loop, not less than 24 inches below grade, to the upper end of the ground rods by exothermic welds. Provide #4/0 bare copper conductors connecting the switchgear grounding provisions to two different ground rods.

3.2.3 Connections

Make joints in grounding conductors and ground loop by exothermic weld or compression connector. Exothermic welds and compression connectors shall be installed as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount switch on concrete slab. Slab shall be at least 12 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab shall be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab shall be approximately 4 inches above finished grade. Edges above grade shall have 1/2 inch chamfer. Slab shall be of adequate size to project at least 8 inches beyond equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with switch cable training areas. Concrete work shall be as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.4 FIELD QUALITY CONTROL

3.4.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, NFPA 70B, NETA ATS and referenced ANSI standards.

Include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.4.1.1 Switchgear

a. Visual and Mechanical Inspection

1. Compare equipment nameplate information with specifications and approved shop drawings.
2. Inspect physical and mechanical condition.
3. Check for proper anchorage, alignment, required area clearances, and grounding.
4. Perform mechanical operator tests in accordance with manufacturer's instructions.
5. Verify that insulating SF6 gas pressure or dielectric fluid level is correct.
6. Inspect all indicating devices for proper operation.

b. Electrical Tests

1. Perform contact-resistance tests.
2. Trip fault interrupters by operation of overcurrent control.
3. Perform insulation-resistance tests.
4. Perform an over-potential test on each switched way pole with the switched way in the open position in accordance with the manufacturer's instructions.

3.4.1.2 Grounding System

a. Visual and Mechanical Inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

1. Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.
2. Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.4.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that devices are in good operating condition and properly performing the intended function. Test shall require each item to perform its function not less than three times. As an exception to requirements stated elsewhere in the contract, notify the Contracting Officer 5 working days in advance of the dates and times for checks and tests.

-- End of Section --