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USACE / NAVFAC / AFCEC **UFGS-26 13 02 (November 2024)**

Preparing Activity: NAVFAC **NEW**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2026
****

SECTION TABLE OF CONTENTS

DIVISION 26 - ELECTRICAL

SECTION 26 13 02

PAD-MOUNTED SOLID DIELECTRIC SWITCHGEAR

11/24

-- End of Section Table of Contents --

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SECTION 26 13 02

PAD-MOUNTED SOLID DIELECTRIC SWITCHGEAR
11/24

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NOTE: This guide specification covers the requirements for Solid dielectric, dead-front, enclosed and non-enclosed, pad-mounted switchgear with load and fault interrupting ways, with maximum ratings of 600 amperes and 38 kV (35kV Class), 60 Hz. 38kV rated switchgear is available but may require proprietary justification. Voltages up to 27kV (25kV Class) and below are available from multiple manufacturers.

Solid Dielectric Switchgear should be considered in locations where flooding or water infiltration are concerns due to site installation conditions. The submersion capability of the equipment is suited to these environments.

Solid Dielectric Switchgear should be considered as an alternate to SF6 insulated switchgear where environmental restrictions on greenhouse gas reductions or potential emissions are a consideration.

The insulation system for solid dielectric insulated switchgear can include any combination of rubberized insulating materials, plastics, phenolic barriers, epoxy (such as cycloaliphatic epoxy) and other solid insulating materials. The use of liquid insulation or synthetic gas insulation in any part of this switchgear is strictly prohibited.

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 item(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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NOTE: This guide specification can be used for subsurface (vault) applications with appropriate modifications.

Use the following related guide specifications for power distribution equipment:

--Section 26 08 00 APPARATUS INSPECTION AND TESTING
--Section 26 11 16 SECONDARY UNIT SUBSTATIONS
--Section 26 11 13.00 20 PRIMARY UNIT SUBSTATION
--Section 26 12 19 PAD-MOUNTED, LIQUID-FILLED, MEDIUM VOLTAGE TRANSFORMERS
--Section 26 12 21 SINGLE-PHASE PAD-MOUNTED TRANSFORMERS
--Section 26 13 00 SF6/HIGH-FIREPOINT FLUIDS INSULATED PAD-MOUNTED SWITCHGEAR
--Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION
--Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION

****

****

NOTE: Verify that the following information is indicated on the project drawings:

1. Site Plan showing location, space available, and desired arrangement of switchgear.

2. Single-line diagram showing: nominal system voltage; number and configuration of switched ways; type, number, frequency, short circuit ratings, BIL,and size of conductors for each circuit; and method of power cable termination (600 ampere deadbreak or 200A load break connectors and adapters for fixed bushings). Individually identify each switched way as load or fault interrupter and single-pole or three-pole tripping.

3. Grounding Detail with ground rods, ground ring and interconnecting cables when interconnecting with other grounding systems or if multiple switches are provided.

4. Special conditions, such as altitude, temperature and humidity, exposure to fumes, vapors, dust, and gases.

5. Surge arrester locations.

6. Power source for automatic switch control and SCADA features.

****

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 Reference Identifier (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.

****

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 A240/A240M	(2025a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM D1535	(2014; R 2018) Standard Practice for Specifying Color by the Munsell System

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386	(2016) Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
IEEE 495	(2007) Guide for Testing Faulted Circuit Indicators
IEEE C2	(2023; ERTA 1 2023; ERTA 2-3 2025) National Electrical Safety Code
IEEE C37.60	(2019) High-Voltage Switchgear and Controlgear - Part 111: Automatic Circuit Reclosers for Alternating Current

	Systems Up to 38 kV
IEEE C37.62	(2020) Standard for Pad-Mounted Dry Vault, Submersible and Overhead Fault Interrupters for Alternating Current Systems Up to and Including 38kV
IEEE C37.74	(2014) 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 C37.75	(2023) Standard for Pad-Mounted, Pole-Mounted, and Submersible Switchgear Enclosures and Associated Control Enclosures - Coastal and Non-Coastal Environmental Integrity
IEEE C57.12.28	(2023) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.12.29	(2023) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments
IEEE C62.11	(2020) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 62271-102	(2018) High-Voltage Switchgear and Controlgear - Part 102: Alternating-Current Disconnectors and Earthing Switches
IEC 62271-103	(2021; Corr 1 2025) High-voltage switchgear and controlgear - Part 103: Alternating current switches for rated
IEC 62271-111	(2019) High Voltage Switchgear And Controlgear - Part 111: Automatic Circuit Reclosers for Alternating Current Systems up to and including 38 kV

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code

NFPA 70B	(2026) Standard for Electrical Equipment Maintenance

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 8500.01	(2014; Change 1-2019) Cybersecurity
DOD 8510.01	(2022) Risk Management Framework (RMF) for DoD Systems

UL SOLUTIONS (UL)

UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment

1.2 RELATED REQUIREMENTS

****
NOTE: Include Section 26 08 00 APPARATUS INSPECTION AND TESTING on all projects involving medium voltage and specialized power distribution equipment.
****

Section 26 08 00 APPARATUS INSPECTION AND TESTING, applies to this section, with the additions and modifications specified herein. Cybersecurity requirements are specified in Section 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS.

1.3 DEFINITIONS

1.3.1 Way

A way is considered a three-phase or single-phase circuit connection to the bus, which may contain combinations of switches and protective devices or may be a solid bus.

1.3.2 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

****
NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets

following the "G" classification with a code of up to three characters 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 and Air Force projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. for information only. When used, a code following the "G" classification 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

Switchgear Drawings; G, [_____]

SD-03 Product Data

****

NOTE: Include the following paragraph when the switchgear will have fault interrupting ways.

****

[Electronic Overcurrent Control Curves; G, [_____]

] Insulated High-Voltage Connectors; G, [_____]

[Surge Arresters; G, [_____]

] Solid Dielectric Insulated Pad-mounted Switchgear; G, [_____]

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

SD-06 Test Reports

Acceptance Checks and Tests; G, [_____]

SD-07 Certificates

Paint Coating System; G, [_____]

[Cybersecurity; G, [_____]

] SD-09 Manufacturer's Field Reports

Switchgear Design and Production Tests; G, [_____]

SD-10 Operation and Maintenance Data

Solid Dielectric 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

d. Nameplate schedule

e. Conduit entry/ exit locations

f. Anchor bolt template and locations

1.5.2 Paint Coating System

****
NOTE: Select IEEE C57.12.29 when specifying stainless steel enclosures.
****

Submit[IEEE C57.12.28][IEEE C57.12.29][IEEE C37.75] paint coating system performance requirement tests.

[1.5.3 Electronic Overcurrent Control Curves

****
NOTE: Include the following if one or more fault interrupting ways are specified and if the time-current curves are not already provided in the specified electrical analysis software package. Most commercially available software packages already contain the time-current curves used in pad-mounted switchgear fault interrupter trip units.
****

Provide time-current characteristic curves in PDF and Excel format and in electronic format suitable for import or updating into the[EasyPower][SKM PowerTools for Windows][ETap] [_____] computer program.

]1.6 MAINTENANCE

1.6.1 Solid Dielectric Insulated Pad-mounted Switchgear Operation and Maintenance

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

[1.7 CYBERSECURITY

****
NOTE: If the equipment will have SCADA or any remote control system capability, this paragraph must be included and the Designer of Record must coordinate with the activity to determine the required Service Implementation Policy. Add the requirements into this specification.
****

All control systems (including systems separate from an energy management control system) must be planned, designed, acquired, executed and maintained in accordance with DOD 8500.01 and DOD 8510.01, and as required by individual Service Imnplementation Policy.

Submit certification that equipment complies with the above DoD instructions and [_____].

]PART 2 PRODUCTS

2.1 SOLID DIELECTRIC INSULATED PAD-MOUNTED SWITCHGEAR

****
NOTE: Add reference to IEC 62271-103 for projects located in Europe only after verifying that at least three manufacturers of this type of switchgear comply with this standard.
****

IEEE C37.74[, IEC 62271-102][, IEC 62271-103]

2.1.1 Ratings and Test Requirements

****
NOTE: Select rated impulse voltage (BIL) to correspond with the selected rated maximum voltage.

Select short circuit current as applicable for the switchgear type and system requirements.
****

The maximum voltage rating of the switchgear must be[15kV][15.5 kV][27 kV][38 kV][as indicated]. Provide the corresponding ratings associated with the required switchgear voltage rating as follows:

****
NOTE: The following optional ratings are available for switchgear assemblies, however, specifying these will require proprietary justification.

1. Optional short-time and short-circuit interrupting current ratings of 16,000, 20,000 and 25,000 rms symmetrical amperes are available depending on voltage. Some of these ratings may be proprietary and not offered at each voltage.

2. Voltage of 38kV.

3. Verify symmetrical rating of bushings specified before selecting ratings above 12.5kA.

****

Rated Maximum Voltage, kV	[15.5] [27] [38]
Rated Withstand Impulse Voltage, kV BIL	[95] [125] [150]
Continuous and Load Interrupting Current, A	[600]
Short-Time Current, kA rms Sym	[[12.5] [16] [20] [25] [_____]]
[Short-Circuit interrupting Current,kA rms Sym]	[[12.5] [16] [20] [25] [_____]]

Provide switch and fault interrupter ways for the required continuous and load interrupting current.

2.1.2 Switchgear Construction

****

NOTE: Select the options below based on the intended configuration. Identify switched ways, fault interrupters, and bus configuration on one line diagrams.

For the Navy: Select the bracketed option to require switch position viewing windows.

Visible contact windows may not be available at higher voltages.

Some manufacturers offer modular individually insulated switched/ fault interrupter ways and others offer components insulated in an overall common tank. Consider keeping the construction type open to either design to avoid proprietary requirements, unless there are dimensional replacement considerations.

Select option for accessory control cabinet only if required for the selected options for the application. A cabinet is typically required for most applications with advanced relaying, SCADA, transfer controls, or battery applications. Include IP 68 rating to match switchgear rating only if control cabinet is expected to be submerged. Option will add cost and complexity to the construction.

****

Provide switchgear with the following construction configuration:

a. Switch contacts and cable entrance terminations contained in a dead front, enclosed in a steel compartment. All penetrations, bussing, switches and interrupters shall be potted in a liquid-tight synthetic solid dielectric insulation compound. Unit shall carry a[IP 68][NEMA 6P] rating on the medium voltage equipment.

b. Configured with[load interrupting][and][fault interrupter] switched ways as indicated.

c. Accessible terminations suitable for cables entering from[below][top].

[d. Switch contact positions for switched ways visible through viewing windows in the switchgear termination compartment.

] e. Each switched way with two position switch; Open and Closed. Grounding provided via grounding parking elbow.

f. Manual operating provisions mounted at switch and capable of hookstick operation per IEEE C37.74.

[2.1.2.1 Pad-mounting Provisions

****
NOTE: For Navy-designed projects, select the option below with the switchgear installed on a concrete pad. For some Army and Air Force projects, installation on a fiberglass pad or above a vault is desired. In these cases, select the second bracketed option below. If the switchgear is installed above a vault, provide details on associated drawings.
****

****
NOTE: Choose stainless steel enclosure where environmental conditions are not suitable for mild steel or where a higher level of corrosion protection is desired. Select IEEE C57.12.29 when enclosure is required to be stainless steel.
****

Provide enclosed switchgear suitable for installation on a concrete pad with[front access][front and rear access], including the following;

[a. Fabricate switchgear[enclosure and] enclosure base of ASTM A240/A240M type 304 or 304L stainless steel.

] b. Enclosure base includes any part of the switchgear enclosure that is within 75 mm 3 inches of concrete pad.

c. Paint enclosure including base ASTM D1535[Munsell 7GY3.29/1.5 green][Munsell 8.3G6.1/0.5 light gray (ANSI No. 61)] [_____].

d. Comply with[IEEE C57.12.28][IEEE C57.12.29] for the paint coating system regardless of equipment material.

[e. Provide[NEMA 4][NEMA 4X][NEMA 6P][IP 68] [_____] accessory control cabinet for[relays][SCADA][transfer controls][instrument transformers][batteries] [_____].

]][2.1.2.2 Pad/Vault-mounting Provisions

****
NOTE: For Navy-designed projects, select the option below with the switchgear installed on a concrete pad. For some Army and Air Force projects, installation on a fiberglass pad or above a vault is desired. In these cases, select the second bracketed option below. If the switchgear is installed above a vault, provide details on associated drawings.
****

****
NOTE: Choose stainless steel enclosure where environmental conditions are not suitable for mild steel or where a higher level of corrosion protection is desired. Select IEEE C57.12.29 when enclosure is required to be stainless steel.
****

[Provide enclosed switchgear suitable for installation on a concrete pad or fiberglass box pad with[front access][front and rear access], including the following:][Provide enclosed switchgear on a concrete vault with[front access][front and rear access], as indicated, including the following:]

[a. Fabricate a switchgear[enclosure and] enclosure base of ASTM A240/A240M type 304 or 304L stainless steel.

] b. Enclosure base includes any part of the switchgear enclosure that is within 75 mm 3 inches of concrete pad.

c. Paint enclosure including base ASTM D1535[Munsell 7GY3.29/1.5 green][Munsell 8.3G6.1/0.5 light gray (ANSI No. 61)] [_____].

d. Comply with[IEEE C57.12.28][IEEE C57.12.29] for the paint coating system regardless of equipment material.

[e. Provide[NEMA 4][NEMA 4X][NEMA 6P][IP68] [_____] accessory control cabinet for[relays][SCADA][transfer controls][instrument transformers][batteries] [_____].

]]2.1.3 Load Interrupting Switched Ways

****
NOTE: Select Single-Pole switching only for single-phase applications, such as housing areas.
****

Provide the following for load interrupter switched ways:

a. [Three][Single]-pole group operated switching.

b. Interrupter switches operated by means of an externally accessible switch-operating handle.

c. Switch-operating handle located at each dead front switch mechanism inside pad-mounted gear enclosure.

d. Pad lockable stainless steel access cover.

e. Labels to indicate switch position.

[f. Switch position viewing window.

][2.1.3.1 Fault Interrupting Ways

****

NOTE: Include the following if fault interrupting ways are required. Fault interrupting ways provide overcurrent protection.

Each manufacturer has different options available for protective relaying. These options have not been addressed below because they are specific to each manufacturer. Consider the requirements for circuit protection and for circuit coordination and modify this paragraph as needed.

The project design must provide for the trip control power source and trip control circuits when selecting remote tripping.

Most manufacturers include standard internal current transformers with self powered basic overcurrent relaying and offer optional advanced microprocessor relaying and current transformer options. Alternate relaying types or current transformer sensitivity may require alternate configurations, external controls enclosures, and external control power and/or battery provisions.

If using internal current transformers with self powered relays, the designer should consider relay "wake-up" time delay for lightly loaded or no load situations on protected circuits which would extend trip time under fault conditions. Consult manufacturers' for parameters. Batteries and control power should be considered if monitoring of relays and status are required when circuits are de-energized.

Identify relaying and instrumentation requirements on one line drawings or schedules on the drawings.

Identify the appropriate operational methodology and incorporate the associated paragraphs from the selections below.

****

IEEE C37.60, IEC 62271-111, IEEE C37.62. Provide non-fused, non-reclosing, manual reset, vacuum interrupters consisting of vacuum

interrupter and a spring or magnetic assisted operating mechanism. Each fault interrupting way must utilize[internal][external] mounted current transformers and an electronic overcurrent control to provide[single-pole][three-pole ganged] tripping[as indicated] for single-phase[and three-phase] faults. Provide microprocessor overcurrent relaying with adjustable settings.[Provide remote tripping via an external dry contact device[as indicated] for fault interrupting ways. Provide[120 Vac][48 Vdc][24 Vdc][from the switchgear itself][from remote trip control power][and internal battery].]

][2.1.4 Automatic Switch Controls

****

NOTE: Select this option only if an automatic switch control system is part of the design.

If this option is selected, the project design must provide a control power source for the automatic switch control system.

Identify the appropriate operational methodology and incorporate the associated paragraphs from the selections below.

Validate voltage monitoring methods with selected voltages, accuracy, and design. Voltage transformers may increase housing size.

****

Provide an automatic switch control system to execute Manual[, SCADA][, Automatic Source-Transfer][, and Fault Detection Isolation and Restoration] operations. Power the switch control system[and associated communication port provisions] from an integral battery-charger DC supply system. Use motor operators and associated motor operator controllers for switch way operation. Use[120 Vac][48 Vdc][24 Vdc] [_____] control power[from switchgear itself][from remote source][and internal battery] for automatic switch control. Utilize[capacitive bushing voltage sensors][voltage transformers] for voltage sensing.

2.1.4.1 Manual Operation

Provide the motor operator controllers with "Close" and "Open" pushbuttons for manual operation.[Provide remote pendant operator to permit manual motor operation at a distance.]

[2.1.4.2 SCADA Operation

****

NOTE: Include the following if a SCADA operation system is required and coordinate with 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS.

****

The automatic switch control system must execute remote commands received from a SCADA master station and transmit switchgear operation information to a SCADA master station via a DNP 3.0 100 Base-FX Ethernet communication port. Include transfer of switch ways to "Close" and "Open" positions[and enabling of the Source-Transfer operation] for execution of remote commands. Include switch way position status, voltage and current

readings, and DC supply system status with communication of switchgear information.

][2.1.4.3 Source-Transfer Operation

****
NOTE: Include the following if source-transfer operation is required.
****

Provide an automatic switch control system that opens an incoming switch way when voltage is lost and closes the alternate incoming switch way if voltage is present. Include with the Source-Transfer controls an overcurrent-lockout feature that prevents automatic closing of a switch way into a system fault. Include provisions for returning the system to the normal configuration via manual, SCADA, or automatic operations when voltage is restored.

][2.1.4.4 Fault Detection Isolation and Restoration Operation

****
NOTE: Provide a conduit system between the pad mount switchgear units for installation of the automatic switch control system optical fiber cable.
****

The automatic switch control system must execute circuit fault detection isolation operation for closed and open loop distribution systems. Provide communication via a peer-to-peer fiber optic network for the pad mount switchgear unit automatic switch control systems. Provide an optical fiber cable approved by the automatic switch control system manufacturer.

]][2.1.5 Low Voltage Test Points

Provide load interrupting switch ways with load side voltage sensors that allow for low voltage checks with relay interface at test point of elbow connectors to confirm energized and in-phase conditions using a standard high-impedance voltmeter.

][2.1.6 Key Interlock

****
NOTE: Add requirements for key interlock if needed. Provide details of interlock system on the drawings.
****

Provide key interlock system as indicated on the drawings.

]2.1.7 Dead-Front High-Voltage Bushings

****
NOTE: Make selection based on system voltage.
****

IEEE 386. [15 kV, 95 kV BIL][25 kV, 125 kV BIL][35 kV, 150 kV BIL]. Provide 600 ampere one-piece deadbreak apparatus bushings for each switched way.

****
NOTE: Include standoff bushings only when the Activity requires the additional items.
****

[a. Parking stands: Provide a parking stand near each dead-front bushing.[Provide insulated standoff bushings for parking of energized load-break connectors on each parking stands.]

]2.2 INSULATED HIGH-VOLTAGE CONNECTORS

****
NOTE: If submersion requirements are a consideration, coordinate submersible ratings of dead break elbows to match requirements. IEEE 386 requirements may not align with switchgear IP/NEMA ratings.
****

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

****
NOTE: Provide 200 ampere bushing interface on all 600 ampere connectors.
****

a. 600 Ampere deadbreak connector ratings: Voltage: [15 kV, 95 kV BIL][25 kV, 125 kV BIL][35 kV, 150 kV BIL]. Short time rating: 25,000 rms symmetrical amperes. Provide connectors with 200 ampere bushing interface.

****
NOTE: Include the following paragraph only when the activity requires additional grounding elbows.
****

[b. Provide[one] [_____] set[s] of three grounding elbows. Deliver grounding elbows to the Contracting Officer.

]2.3 GROUNDING PROVISIONS

Provide a ground-connection pad in each termination compartment.[Provide a continuous copper ground bus across the full width of each termination compartment switched way.]

****
NOTE: Include the following paragraph only when the activity requires additional grounding elbows and feed-thru inserts.
****

[a. Provide[[one][_____] set[s] of three grounding elbows][and][[one][_____] set[s] of three feed-thru inserts]. [Grounding elbows][and][Feed-thru inserts]. Deliver to the Contracting Officer.
] **********
NOTE: Include the following paragraph only when the activity requires additional grounding elbows and grounded standoff bushings.

****

[b. Provide[[one][_____] set[s] of three grounding elbows][and][[one][_____] set[s] of three grounded standoff brushings]. [Grounding elbows][and][Grounded standoff bushings.] Deliver to the Contracting Officer.

][2.4 FAULTED CIRCUIT INDICATORS

****

NOTE: If fault indicators are desired, determine type and locations. provide information on the drawings.

****

Install one set of faulted circuit indicators on the test points of each set of separable insulated connectors. Faulted circuit indicators must comply with IEEE 495. Indicators must be self powered; with automatic trip with mechanical flag indication upon overcurrent followed by loss of system voltage. Indicators must be compact, sealed corrosion resistant construction with provision for hotstick installation and operation.

][2.5 SURGE ARRESTERS

****

NOTE: Provide elbow type arresters at normally open switch locations.

****

IEEE C62.11, rated[[3][6][9][10][12][15] [_____] kV][as indicated], fully shielded, dead-front, metal-oxide-varistor, elbow type with resistance-graded gap, suitable for plugging into inserts. Provide arresters on switched ways as indicated.

]2.6 SOURCE QUALITY CONTROL

2.6.1 Switchgear Design and Production Tests

****

NOTE: Include IEEE C37.60, IEEE C37.62 and IEC 62271-111 when the switchgear will have fault interrupting ways.

****

****

NOTE: Add reference to IEC 62271-103 and IEC 62271-111 for projects located in Europe only after verifying that at least three manufacturers of this switchgear comply with this standard.

****

Furnish reports which include results of design and production tests performed according to IEEE C37.74[, IEC 62271-103][and IEEE C37.60, IEEE C37.62[, IEC 62271-111]]. Perform manufacturer production tests on each switchgear assembly to ensure that design performance is maintained in production.

PART 3 EXECUTION

3.1 INSTALLATION

Conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.2 GROUNDING

****
NOTE: Where rock or other soil conditions prevent obtaining a specified ground value, other methods of grounding should be specified. Where it is impractical to obtain indicated ground resistance values, the designer should make every effort, within reason, to obtain ground resistance values as near as possible to the indicated values.
****

NFPA 70 and IEEE C2, except provide grounds and grounding systems with a resistance to solid earth ground not exceeding[25] [_____] 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" applies.

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][as indicated].

3.2.2 Switchgear Grounding

Connect No. 4/0 bare copper conductor ground ring, not less than 600 mm 24 inches below grade, to the upper end of the ground rods by exothermic welds or compression connectors. Provide No. 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 ring by exothermic weld or compression connector. Install exothermic welds and compression connectors 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

****
NOTE: Select from the bracketed options below for the selected installation method. Coordinate with paragraphs PAD-MOUNTING PROVISIONS and PAD/VAULT-MOUNTING PROVISIONS.
****

Mount switch[on concrete slab][on concrete box pad][on fiberglass pad][on fiberglass box pad][on concrete vault][as shown on the drawings],

including the following:

[a. Provide box pad with a minimum depth of [813][915] mm [32][36] inches [_____].

][b. Show vault size on the drawings.

][c. Provide slab size at least 300 mm 12 inches thick, reinforced with a 152 by 152 - MW19 by MW19 6 by 6- W2.9 by W2.9 mesh, placed uniformly 100 mm 4 inches from the top of the slab.

] d. Place[slab][box pad] on a 150 mm 6 inch thick, well-compacted gravel base.

e. Install top of concrete slab approximately 100 mm 4 inches above finished grade. Provide edges above grade with 15 mm 1/2 inch chamfer.

f. Provide[slab][box pad] of adequate size to project at least 200 mm 8 inches beyond equipment.

[g. [For installations that use a box pad or vault, train the incoming cables around the box or vault prior to terminating at the switchgear.][Stub up conduits, with bushings, 50 mm 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with switch cable training areas. Provide concrete work 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. Submit reports, including acceptance criteria and limits for each test in accordance with NETA ATS "Test Values".

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) Inspect all indicating devices for proper operation.

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NOTE: Include the following option when key interlocking is specified.

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[(6) Test interlock systems for proper operation and sequencing.

] b. Electrical Tests

(1) Perform contact-resistance tests.

[(2) Trip fault interrupters by operation of overcurrent control[and remote trip].

] (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.

[(5) Set fault interrupter overcurrent control in accordance with government provided settings. Request settings from government, in writing, a minimum of 30 days prior to scheduling electrical tests.

]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 resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. Use an instrument 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, show by demonstration in service that devices are in good operating condition and properly performing the intended function. Perform each test function not less than three times. As an exception to requirements stated elsewhere in the contract, notify the Contracting Officer five working days in advance of the dates and times for checks and tests.

3.5 FIELD APPLIED PAINTING

[Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.][Apply field painting as specified in Section 09 90 00 PAINTS AND COATINGS.]

-- End of Section --