UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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DIVISION 26 - ELECTRICAL

SECTION 26 13 00

SF6/HIGH-FIREPOINT FLUIDS INSULATED PAD-MOUNTED SWITCHGEAR

11/14

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****

USACE / NAVFAC / AFCEC / NASA	**UFGS-26 13 00 (November 2014)**

Preparing Activity: NAVFAC	**Superseding**
	UFGS-26 13 00.00 20 (August 2011)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

****

SECTION 26 13 00

SF6/HIGH-FIREPOINT FLUIDS INSULATED PAD-MOUNTED SWITCHGEAR
11/14

****

NOTE: This guide specification covers the requirements for SF6 or high-firepoint biodegradable fluid insulated, dead-front, enclosed and non-enclosed, pad-mounted switchgear with load and fault interrupting switched ways, with maximum ratings of 600 amperes and 38 kV, 60 Hz.

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).

****

****

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 19.10 THREE-PHASE, LIQUID-FILLED PAD-MOUNTED TRANSFORMERS
--Section 26 12 21 SINGLE-PHASE PAD-MOUNTED TRANSFORMERS
--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, and size of conductors for each circuit; and method of power cable termination (600 ampere deadbreak connectors). 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 A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM D1535	(2014; R 2018) Standard Practice for Specifying Color by the Munsell System
ASTM D2472	(2000; R 2014) Standard Specification for Sulphur Hexafluoride
ASTM D6871	(2017) Standard Specification for Natural (Vegetable Oil) Ester Fluids Used in Electrical Apparatus

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 C2	(2017; Errata 1-2 2017; INT 1 2017) 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 C37.74	(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 C57.12.28	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.12.29	(2014) 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	(2017; Errata 2017) 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
IEC 62271-103	(2013; Corr 1 2013) High-Voltage Switchgear and Controlgear – Part 103: Switches for Rated Voltages Above 1 Kv up to and Including 52 Kv
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	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 70B	(2019) Recommended Practice for Electrical Equipment Maintenance

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 8500.01	(2014; Change 1-2019) Cybersecurity
DOD 8510.01	(2014; Change 1-2016; Change 2-2017) Risk Management Framework (RMF) for DoD Information Technology (IT)

UNDERWRITERS LABORATORIES (UL)

UL 467	(2013; Reprint Jun 2017) 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.

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

****

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, Air Force, and NASA 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.

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" 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 switched ways.

****

[Electronic Overcurrent Control Curves; G[, [_____]]]

SF6/High-Firepoint Fluid 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.

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

Surge Arresters; G[, [_____]]

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

SF6/High-Firepoint Fluid Insulated Pad-mounted Switchgear, 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

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

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

1.5.3 [Electronic Overcurrent Control Curves

****

NOTE: Include the following if one or more fault interrupting switched 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 format and in electronic format suitable for import or updating into the [EasyPower] [SKM PowerTools for Windows] [_____] computer program).

]1.6 MAINTENANCE

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

Submit Operation and Maintenance Manuals in accordance with Section 01 78 23OPERATION 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 Implementation Policy.

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

]PART 2 PRODUCTS

2.1 SF6/HIGH-FIREPOINT FLUID 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 switchgear comply with this standard.

****

IEEE C37.74[, 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 voltage rating of the switchgear must be [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.

2. For Norfolk Naval Shipyard projects, select optional 25,000 rms symmetrical amperes short-time and short-circuit interrupting current ratings for switchgear assemblies that are to be installed on the 11.5 kV system.

3. Switchgear is available that is rated for only 200 amperes continuous current, which might be suitable for housing areas or lateral circuits using low-ampacity conductors such as #2 awg. If 200-ampere rated switchgear is desired, modify the table as needed.

****

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

2.1.2 Switchgear Construction

****

NOTE: Select the options below based on the intended configuration.

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

For the Navy: Select the bracketed option to require the three position switch: Open, Closed, Ground.
****

Provide switchgear with switch contacts and cable entrance terminations contained in a sealed, dielectric-filled stainless steel tank. Switchgear must 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. Configure switchgear with[load interrupting][and][fault interrupting] switched ways as indicated. Provide switchgear with front accessible terminations suitable for cables entering from below with manual operating provisions either mounted on the rear or capable of hookstick operation per IEEE C37.74.[Switch contact positions for switched ways must 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.[Provide each switched way with three position switch; Open, Closed, Ground.]

2.1.2.1 Pad-mounting Provisions

****
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 [non-]enclosed switchgear suitable for installation on a concrete pad. Fabricate switchgear[support frame][enclosure base][enclosure] with ASTM A167 type 304 or 304L stainless steel.[Enclosure base must include any part of the switchgear enclosure that is within 75 mm 3 inches of concrete pad.] Paint [switchgear tank and support frame][enclosure including base] ASTM D1535 Munsell 7GY3.29/1.5 green. Comply with [IEEE C57.12.28][IEEE C57.12.29] for the paint coating system regardless of equipment material.

2.1.3 Load Interrupting Switched Ways

****
NOTE: Specify the required configuration of load interrupting switched ways and fault interrupting switched ways.
****

[2.1.3.1 Three-Pole Group Operated Switched Ways

Provide three-pole group operated load interrupting switched ways as indicated.

][2.1.3.2 Single-Pole Operated Switched Ways

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

Provide single-pole operated load interrupting switched ways as indicated.

][2.1.3.3 Fault Interrupting Switched Ways

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

Each manufacturer has different options available for electronic trip units. 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.

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

IEEE C37.60, IEC 62271-111. Provide non-fused, non-reclosing, manual reset, vacuum interrupters consisting of vacuum interrupter and a spring assisted operating mechanism. Each fault interrupting switched way must utilize internally 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 electronic overcurrent control with provisions for a minimum of ten field changeable overcurrent trip settings.[Provide remote tripping via an external dry contact device[as indicated] for fault interrupting switched ways. Provide[120 Vac][48 Vdc] remote trip control power.]

]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 120 Vac control power source for the automatic switch control system.

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

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 control power for automatic switch control.

2.1.4.1 Manual Operation

Provide the motor operator controllers with "Close" and "Open" pushbuttons for manual operation.

[2.1.4.2 SCADA Operation

****
NOTE: Include the following if a SCADA operation system is required and coordinate with bracketed option paragraph entitled "Cybersecurity".
****

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 100Base-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 Pins

Provide load interrupting switch ways with 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.

]2.1.6 [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

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 [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.

]2.4 [SF6 Refill Cylinders

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

]2.5 SOURCE QUALITY CONTROL

2.5.1 Switchgear Design and Production Tests

****
NOTE: Include IEEE C37.60 and IEC 62271-111 when the switchgear will have fault interrupting switched 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[, 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 #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 #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

Mount switch on concrete slab. Provide slab with dimensions 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. Place slab on a 150 mm 6 inch thick, well-compacted gravel base. Install top of concrete slab approximately 100 mm 4 inches above finished grade. Provide edges above grade with 15 mm 1/2 inch chamfer. Provide slab of adequate size to project at least 200 mm 8 inches beyond equipment.

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.

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.

****

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

****

[7. 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.

-- End of Section --