

SECTION [26 13 23.17]

MEDIUM VOLTAGE METAL-ENCLOSED SWITCHGEAR – 2SIS

Square D Premset™ Shielded Solid Insulated Switchgear by Schneider Electric

Schneider Electric Editor's Note:

This guide specification is written in accordance with the Construction Specifications Institute (CSI) Master Format. This section must be carefully reviewed and edited by the architect or the engineer to meet the requirements of the project. Coordinate this section with other specification sections within the Contract Documents and Drawings.

To properly use / edit this document, show formatting and hidden text by selecting ¶ on the menu or by typing (Ctrl+*) simultaneously. Except for these introductory and closing paragraphs, green hidden text will not print. Text in red is optional. Red text in [brackets] denotes multiple options where one or more should be chosen. All red text should be edited and changed to black for final project conformation. In addition, these introductory paragraphs should be deleted or changed to hidden text.

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration and installation for medium voltage metal-enclosed shielded solid insulated switchgear (also identified as shielded solid insulated switchgear, medium voltage switchgear, 2SIS, 2SIS SWGR, MV 2SIS or MV SWGR) as required for the complete performance of the Work, as shown on the Drawings, as specified herein.
- B. Related Sections: Related sections include, but shall not be limited to, the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
 - 2. Applicable general requirements for electrical Work specified within Division 26 Specification Sections apply to this Section.
 - 3. The following information is typically depicted on the Drawings: bus configuration, bus ratings, [interrupting ratings,] circuit breaker ratings, circuit breaker protective relaying, elevation and footprint, etc. Where not shown on or able to be derived from the Drawings, the minimum requirements specified herein shall be provided.
 - 4. Refer to specification Section 26 09 17 Protective Relays and Controllers for additional requirements.
 - 5. Refer to specification Section 26 27 13.13 Power and Energy Meters for additional requirements.
 - 6. Refer to specification Section 26 27 13.16 Power Quality Meters for additional requirements.
 - 7. Refer to specification Section 13 34 23.11 Fabricated Electrical Houses for additional requirements
 - 8. Refer to specification Section 26 09 13 Electrical Power Management Systems for additional requirements

1.2 REFERENCES

- A. General, Publications: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM B-117, "Standard Practice for Operating Salt Spray (Fog) Apparatus"

2. Canadian Standards Association (CSA).
 - a. C22.2 No. 31, "Switchgear Assemblies"
 - b. C22.1, "Canadian Electrical Code, Part I (CEC)"
3. Institute of Electrical and Electronic Engineers (IEEE)
 - a. ANSI/IEEE C37.20.3, "IEEE Standard for Metal-Enclosed Interrupter Switchgear"
 - b. ANSI/IEEE C37.04, "Standard Rating Structure for AC High-Voltage Circuit Breakers"
 - c. ANSI/IEEE C37.06, "Standard AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis"
 - d. ANSI/IEEE C37.09, "Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis"
 - e. ANSI/IEEE C37.11, "Standard Requirements for Electrical Control for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis"
 - f. ANSI/IEEE 386, "Standard for Separable Insulated Connector System for Power Distribution System above 600V"
4. International Code Council (ICC)
 - a. IBC, "International Building Code"
5. International Electrotechnical Commission (IEC)
 - a. IEC 60044-1, "Instrument Transformers – Part 1: Current Transformers"
 - b. IEC 60044-2, "Instrument Transformers – Part 2: Voltage Transformers"
 - c. IEC 60044-8: Part 8, "Instrument Transformers: Low Power Current Transducers"
 - d. IEC 62271: Part 201, "High-voltage switchgear and control gear: AC solid-insulation enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV"
 - e. IEC 60255, "Electrical Relays"
6. National Electrical Manufacturers Association (NEMA)
 - a. NEMA SG4, "Alternating Current High Voltage Circuit Breakers"
 - b. NEMA SG5, "Power Switchgear Assemblies"
 - c. NEMA SG6, "Power Switching Equipment"
7. National Fire Protection Agency (NFPA)
 - a. NFPA 70, "National Electrical Code (NEC)"

1.3 DEFINITIONS

- A. Unless specifically defined within the Contract Documents, the words or acronyms contained within this specification shall be as defined within, or by the references listed within this specification, the Contract Documents, or, if not listed by either, by common
 1. 2SIS or 2SIS SWGR: Shielded Solid Insulated Switchgear

1.4 SUBMITTALS

- A. General: Submittals shall be in accordance with the requirements of Section [01 33 00][01300] Submittals and Section [26 00 10][16010] Electrical, in addition to those specified herein.
 1. Submit sufficient information to determine compliance with the Contract Documents. Identify submittal data with the specific equipment tags and/or service descriptions to which they pertain. Submittal data shall be clearly marked to identify the specific model numbers, options, and features of equipment and work proposed.
 2. Deviations from the Contract Documents shall be indicated within the submittal. Each deviation shall reference the corresponding drawing or specification number, show the Contract Document requirement text and/or illustration, and shall be accompanied by a detailed written justification for the deviation.

- B. Operation & Maintenance (O&M) manuals shall be provided in accordance with the minimum requirements specified in Section [01 78 23][1780] Operation and Maintenance Data, Section [26 00 10][16010] Electrical Requirements and additional requirements specified herein.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five years.
 - 1. The manufacturer shall have a valid ISO 9001 certification and an applicable quality assurance system that is regularly reviewed and audited by a third party registrar. Manufacturing, inspection, and testing procedures shall be developed and controlled under the guidelines of the quality assurance system.
 - 2. The manufacturer shall have the ISO 14001 Environment Certification and shall supply the Product Environmental Profile (P.E.P.) upon request of the Engineer.
 - 3. The manufacturer or their representative shall have service, repair, and technical support services available 24 hours 7 days a week basis.
- B. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with project utilizing medium voltage switchgear similar in type and scope to that require for this Project and shall be approved by the manufacturer.
- C. All work performed and all materials used shall be in accordance with the [National Electrical Code], [Canadian Electrical Code] and with applicable local regulations and ordinances. Process controllers, assemblies, materials, and equipment shall be listed and labeled by Underwriter's Laboratories or by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. In addition, protect electronics from all forms of electrical and magnetic energy that could reasonably cause damage.
- B. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.
- C. Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

1.7 WARRANTY

- A. General: Refer to [Section 01 77 00 - Closeout Procedures] [Section 01770 - Closeout Procedures].
- B. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.8 SPECIAL TOOLS AND SPARE PARTS [- NOT USED]

- A. The Contractor shall provide a recommended spare parts list with the following information provided as a minimum:

1. Contact information for the closest parts stocking location to the Owner.
 2. Critical spare parts shall be identified as those parts being associated with long lead times and/or those being critical to the unit's operation.
 3. Maintenance spares shall be identified as being those parts required to regularly perform scheduled maintenance on the furnished equipment. These spares shall include, but shall not be limited to, consumable spares that are required to be exchanged during scheduled maintenance periods.
- B. Spare parts shall be provided for each type and size of unit furnished. At a minimum, the following shall be provided:
1. Provide the minimum spare parts recommended by the manufacturer.
 2. Provide [1] set of each type of power and control fuse installed within equipment
 3. Provide a minimum of [1] operating handle used for manual spring charging and ground switch operation.
 4. The switchgear shall include an installation kit that shall consist of the following:
 - a. [1] spare busbar cap of each type used
 - b. [1] 24mm hex-head socket for the installation of the busbar caps
 - c. [1] bag of spare hardware for cubicle assembly
 5. Provide a minimum of [1] can(s) of touch-up paint to cover blemishes incurred during shipping and installation.
- C. Any manufacturer specific special tool, not normally found in an electrician's toolbox, required to remove and install recommended or furnished spare parts shall be furnished. At a minimum the following shall be provided:
1. If available from manufacture, provide PC-based configuration software tool and a minimum of [one] communication interface cable for each type of cable required to connect a PC-based computer to the devices specified herein for configuration and programming.
 2. Electronic configuration files, in a media format acceptable by the Owner (e.g. CD, USB stick, etc.), updated to an as-installed and commissioned state.
- D. Spare parts shall be properly marked and packaged for long term storage. Printed circuit boards shall be provided in separate anti-static containers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. [Basis-of-Design Product: Subject to compliance with requirements, provide Premset 2SIS Switchgear by Schneider Electric.]
- B. Acceptable Products: Medium voltage switchgear specified herein shall be the product of a single manufacturer. Products and manufacturers specified are to establish a standard of quality for design, function, materials, and appearance. Products shall be modified as necessary by the manufacturer for compliance with requirements. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date:
1. Square D Premset 2SIS Switchgear by Schneider Electric
 2. [2nd manufacturer and model]
 3. [3rd manufacturer and model]

2.2 GENERAL REQUIREMENTS

- A. Service Conditions: The switchgear shall be normally rated under the following conditions:
 - 1. Altitude: Maximum of 3000m
 - 2. Ambient Operating Temperature: +40°C to -25°C
 - 3. Ambient Storage Temperature: +80°C to -40°C
 - 4. Maximum Humidity: 95% relative humidity
- B. The following information is typically depicted on the Drawings: bus configuration, bus ratings, [interrupting ratings,] circuit breaker ratings, circuit breaker protective relaying, elevation and footprint, etc. Where not shown on or able to be derived from the Drawings, the minimum requirements specified herein shall be provided.

2.3 SWITCHGEAR ASSEMBLY

- A. The switchgear shall consist of cubicles containing a circuit breaker, internal grounding switch, and all necessary components and accessories factory assembled and operationally checked.
- B. The assembly shall be self-supporting and floor mounted on a level concrete pad. The integrated switchgear assembly shall withstand the effects of closing, carrying and interrupting currents up to the assigned maximum short circuit rating.
- C. System voltage: [_____] kV nominal, three-phase [solidly grounded] [resistance grounded system]
- D. Rated frequency: [50][60] Hz
- E. Maximum design voltage: [5] [15] kV.
- F. Impulse withstand (Basic Impulse Level): [60] [95] kV.
- G. Power frequency withstand: [19] [36] kV, 1 minute test.
- H. Main bus ampacity: [600] [1200] amps, continuous.
- I. Short time withstand current (main and ground bus): 25kA symmetrical, 2 second test.
- J. Circuit breaker close and latch rating: 65kA asymmetrical
- K. The control voltage used for powering relays, meters, breaker operation, and other low voltage devices shall be: [24VDC] [48VDC] [125VDC] [250VDC] [120VAC] [240VAC].
 - 1. Provide one capacitor trip unit (20 sec.) for each circuit breaker where ac control power is utilized.
- L. The switchgear shall implement a shielded solid insulation system by molding and enclosing all current carrying materials of the switchgear in EPDM (ethylene propylene diene monomer) rubber. An additional conductive or semi-conductive layer shall then be added to the top of the insulation layer in order to set all interior surfaces at ground potential. This system shall be implemented on each bus phase individually and shall be implemented throughout the switchgear including main bus bars, circuit breaker, isolating ground switch, and cable bussing.
- M. The switchgear shall be rated as class PA, accidentally touchable, as defined by IEC 62271 Part 201 as a result of designing for minimum allowable levels of ground leakage current.

2.4 COMPONENTS

- A. Vacuum Circuit Breaker

1. Vacuum circuit breakers shall be provided for all load and fault interruption. The circuit breaker shall be permanently fixed and factory enclosed to protect from environmental contaminants. The vacuum interrupter contacts including the mechanism for operating the movable side of the contacts shall be maintenance free for the lifetime of the switchgear.
2. The circuit breaker shall be rated for a maximum of 3 cycles of interrupting time.
3. The circuit breaker operating mechanism shall be a stored energy type operating mechanism. It shall include a handle operated spring charging mechanism for manual operation and an internal spring charging motor for remote operation. The closing speed of the moving contacts shall be independent of both the control voltage and the operator.
4. Circuit Breaker Operating Sequence: O-0.3s-CO-15s-CO
5. The front of each circuit breaker shall include an active mimic bus with indication of the status of the circuit breaker and isolating ground switch.
6. The circuit breaker shall be solidly and permanently connected to the rest of the current carrying bussing system
7. The front panel of the circuit breaker shall be removable without opening any compartment doors for ease of inspection and maintenance of the mechanism.
8. Each circuit breaker shall be supplied with 4NO/4NC auxiliary contacts.

B. Isolating Ground Switch

1. Each circuit breaker cubicle shall include an isolating ground switch integral to the switchgear. The switch shall be a two-position switch consisting of a circuit breaker connected position and a cable grounded position.
2. The circuit breaker and isolating ground switch shall be safety interlocked such that the ground switch shall not be operable when the circuit breaker is in the closed position, and the circuit breaker will not be operable when the grounding switch is in the cable grounded position.
3. The cable compartment panel shall be mechanically interlocked with the isolating ground switch such that the cable compartment shall not be accessible unless the cables are in a grounded state.
4. The isolating ground switch shall be rated for a minimum of 1000 mechanical operations and a minimum of five (5) 25kA current fault making operations.

C. Cable Compartment/Ground Bus

1. Cable connection shall be dead-break, bolted cable elbow connections.
2. The ground bus shall extend throughout the cable compartment for the full length of the switchgear.
3. Additional vertical sections for cable connections shall not be required except for cable bus taps where required.
4. When shown on the drawings, include a set of elbow style distribution class surge arrestors in the cable compartment designated. The surge arrestors shall be appropriately sized for the system voltage.

D. Main Bus

1. The main bus is to be rated [600] [1200] amps and be fully insulated and ground shielded for its entire length. Bussing shall be [aluminum] [copper].
2. Main bus shall not require any additional supporting system for structural integrity.

E. Doors and Panels

1. Relays, meters, control switches, etc., shall be mounted in a low voltage equipment compartment with hinged doors and hand operable knobs for latching.

F. Instrument Transformers

1. Each cubicle shall allow for two sets of current transformers mounted on the cable side of the vacuum circuit breaker. Current transformers shall be wired to shorting terminal blocks. Current transformer ratios shall be as labeled in the drawings.
2. [Current transformers shall be air-core, Rogowski coil style CTs with linear secondary output for the entirety of their rated current range.][Cable compartment shall allow for installation of an additional set of window style current transformers around each cable phase.]
3. Voltage Transformers shall be low power style transformers of the resistive divider type. Voltage transformers shall be included as marked in the drawings.
4. The low power voltage transformers shall contain internal surge protection.
5. Cable side voltage transformers shall not require an additional cubicle beyond the breaker cubicle in which they are contained.
6. Voltage transformer secondary shall be less than 5V_{peak}. A voltage power amplifier shall be included to raise the secondary voltage to a 120V_{peak} level to create the voltage measurement bus.

G. Control Wiring

1. The switchgear shall be wired with type SIS #14 AWG, except where larger size wire is specified. The switchgear shall be provided with terminal blocks for customer control wire terminations. Wire markers shall be provided for each end of all control wires.
2. Current transformer secondary connections shall be made with ring lug connections on shorting terminal blocks.
3. Connections for control power shall be made with ring lugs.

H. Live Cable Interlock

1. Any circuit breaker unit shall be able to receive, as an option, a dedicated device preventing the isolating ground switch from being closed into the grounded position if cables are still energized. This device should be locked-out in case of auxiliary power loss, with overriding by key interlock.
2. All main circuit breakers shall include live cable interlocks.
3. Feeders circuit breakers shall include live cable interlocks as indicated on the drawings.

2.5 PROTECTIVE RELAYS

- A. [Provide a protective relay for each circuit breaker as specified in Section 26 09 17 Protective Relays and Controllers and as indicated on Drawings. Protective relays shall meet the minimum requirements for the circuit breaker application (main, feeder, busbar, capacitor, transformer, generator, etc.) with the protection types (ANSI/IEEE C37.2 device numbers) and protection levels (basic, standard, advanced) specified or shown.]
- B. Provide relays as indicated on drawings for each circuit breaker.
 1. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: Sepam by Schneider Electric, [2nd manufacturer and model], [3rd manufacturer and model].
 2. The relay shall provide the protection, control, and communications functions of individual circuit breakers.
 3. The relay shall include both local and remote trip indication.
 4. The relay shall accept 1A secondary CT inputs.

5. The relay current input module shall automatically short the CT's when disconnected from the relay to allow for safe disconnection.
6. The relay shall have dedicated trip elements for zone selective interlocking (ZSI).
7. The relays shall have an optional remote display.
8. Relay shall allow for communication via Modbus or DNP over RS-485 or Modbus TCP/IP or IEC61850.
9. The relay shall provide a minimum of the following protection/control elements: annunciation (30), negative sequence/unbalanced current (46), overcurrent (50/51), neutral overcurrent (50N/51N), ground overcurrent (50G/51G), breaker failure (50BF), zone selective interlocking (68), latching/lockout (86), circuit breaker control (94/69), native support for AMS/ERMS.
10. Relay shall contain a minimum of 10 inputs and 8 outputs.
11. The relay shall have a modular communications card to allow for future expansion.
12. The relay shall have a USB connection port for programming.
13. The relay shall provide at minimum 9 programmable LED's.
14. Relay shall provide metering values for sensors connected. Where current sensors are connected the relay shall allow for user programmable demand intervals. The relay shall provide a minimum of two independent setting groups.
15. Relay control outputs shall meet the ANSI C37.90 standard.
16. Relay shall provide a Form C internal failure contact (watchdog).
17. Relay shall provide conformal coating as a standard.
18. Relay shall be UL listed and CSA certified.
19. Relay breaker trip contact shall have optional pulse programming.
20. Relay shall have a freely available programming software that is backwards compatible with all protective relays of same manufacture and model series. Relay software shall contain all relay manuals including installation, commissioning, and operation manuals natively; not requiring a separate download.

2.6 POWER METERING [- NOT USED]

A. Provide a power meter for each application [shown on drawings] as follows:

1. MV Mains: The metering device used to monitor the medium voltage mains for network management, energy cost allocation, power quality analysis, asset management, operational efficiency, and compliance reporting, shall be an Advanced Power Quality Meter as specified in Section 26 27 13.16 Power Quality Meters.
2. MV Feeders: The metering device used to monitor the medium voltage feeders for network management, energy cost allocation, power quality analysis, asset management, operational efficiency, and compliance reporting, shall be a Power Quality Meter as specified in Section 26 27 13.16 Power Quality Meters.
3. Utility Revenue: The revenue grade metering device used to monitor incoming utility medium voltage mains for grid revenue, substation automation, network management, energy cost allocation, power quality analysis, asset management, operational efficiency, and compliance reporting, shall be a Utility Revenue Power Quality Meter as specified in Section 26 27 13.16 Power Quality Meters.
4. Transfer Switches: The metering device used to monitor transfer switches for purposes of automated generator test documentation such as Emergency Power Supply System (EPSS) Test Automation, shall be a Power Quality Meter as specified in Section 26 27 13.16 Power Quality Meters.
5. Generators: The metering device used to monitor generators for purposes of automated generator test documentation[, Emergency Power Supply System (EPSS) Test Automation] shall be an Advanced Power Quality Meter as specified in Section 26 27 13.16 Power Quality Meters.

- A. Provide a power meter for each application [shown on drawings] as follows:
1. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: PowerLogic™ PM5000 by Schneider Electric, [2nd manufacturer and model], [3rd manufacturer and model].
 2. The metering device used to monitor circuits for purposes of network management, energy cost management, energy allocation, and operational efficiency shall have the following minimum features:
 - a. Connections and form factor - direct connect to circuits up to 600 VAC, eliminating the need for voltage (potential) transformers; five (5) amperes (A) nominal current inputs. Removable connectors for voltage inputs, control power, communications, inputs and outputs; easily mountable in the pre-made cutout without tools; form factor will be ¼ DIN with 92 X 92 cut-out and 96 x 96 panel mount integrated display.
 - b. Supported monitoring parameters—full range of 3-phase voltage, measure each phase and neutral current using 4 current inputs, power and energy measurements, power factor, frequency, total harmonic distortion (THD), individual power harmonics (up to 63rd order).
 - c. Accuracy standards - use four-quadrant metering and sample current/voltage simultaneously without gaps with 64 samples per cycle (zero blind); comply with ANSI C12.20 class 0.2 and IEC 61557-12 class 0.2 for revenue meters.
 - d. Display - Backlit dot-matrix LCD display, anti-glare and scratch resistant with a minimum of 128 x128 pixels, capable of displaying four values in one screen simultaneously; a summary screen to allow the user to view a snapshot of the system; support either integrated or remote display.
 - e. Support four (4) digital inputs for Demand Synch Pulse, Time Synch Input, and Conditional Energy Control; have two (2) digital outputs that operate either by user command sent over communication link, or in response to a user defined alarm or event.
 - f. Communications - serial RS-485 Modbus, Ethernet Modbus TCP, and Ethernet BACnet IP (BTL listed); provide two Ethernet ports to allow wiring from meter to meter as a daisy-chain; be capable of serving data over the Ethernet network accessible through a standard web browser; the monitor shall contain default pages from the factory.
 - g. Onboard data logging capabilities - to log data, alarms and events; logged information shall include data logs, minimum/maximum log files of selected parameter values, and alarm logs for each user defined alarm or event log; support the following on-board nonvolatile memory—14 parameters every 15 minutes for 90 days.
 - h. Alarming capabilities - support 29 set-point driven alarms, four (4) digital alarms, (4) unary alarms, 10 Boolean alarms and five (5) custom alarms; user definable alarm events; set-point driven alarms shall be available for voltage/current parameters, input status, and end of interval status; shall send emails and/or text messages containing alarm condition indication via Simple Mail Transfer Protocol [SMTP]; Shall have the capability to manage and monitor devices on the IP network via Simple Network Management Protocol [SNMP]; Indication of an alarm condition shall be delivered by SNMP Traps.
 - i. Firmware-upgradeable to enhance functionality through the Ethernet or serial communication connection and shall allow upgrades of individual meters or groups.
 - j. Integrated gateway functionality, enabling the capability to connect via Ethernet to downstream, serially connected devices.
 - k. Designed accordingly to eco-design complying with ISO 14062, especially MCCB materials shall be halogen free type; designed for easy disassembly and recycling at end of life, and comply with environmental directives ROHS and WEEE.
 - l. The meter shall provide 4 digital inputs configurable for input metering with on-board pulse weight calculation and conversion to standard units for external water, air, gas, electrical or steam (WAGES) meters.

2.7 ACCESSORIES

A. Cable Test Device

1. Where designated on the drawings, provide a dedicated device for cable testing allowing the cable test equipment to be connected from the front of the cubicle without opening the cable compartment. The cable test device must be fully interlocked with the isolating ground switch.

B. Undervoltage Trip Coil

1. An undervoltage trip coil shall be included in each breaker to trip in the event of loss or undervoltage of control power.

C. Additional Trip Coil

1. An additional trip coil shall be included with each breaker at the same control power voltage as the rest of the system.

D. Key Interlocks

1. Key interlocks shall be used to interlock either the circuit breaker or the disconnecting ground switch to enhance the safety and operation of the switchgear. The key interlock scheme shall be configured per the following description or as noted in the drawings.

E. Busbar Grounding Switch

1. The switchgear shall include a busbar grounding switch which will reside in a separate 14.75-inch wide section, and shall be dedicated to the grounding of all three phases of the horizontal ground bus. The grounding switch shall use the same method and operation as the circuit breaker sections in order to facilitate ease of use. The busbar grounding switch shall be positively interlocked to prevent the grounding of the power bus when voltage is present on the power bus. The busbar grounding switch section shall be colored and labelled as to distinguish it without question as a section serving the grounding of the busbar.

2.8 FABRICATION

- A. Construction: Each equipment bay shall be a separately constructed cubicle assembled to form a rigid freestanding unit. Adjacent bays shall be securely bolted together to form an integrated rigid structure. Each individual unit shall be braced to prevent distortion.
- B. Dimensions: Base form dimensions per indoor section are: 14.75 in W x 70 in H x 36 in D
- C. The switchgear shall be fully assembled, inspected and tested at the factory prior to shipment. Large line-ups shall be split to permit normal shipping and handling as well as for ease of rejoining at the job site.
- D. All steel parts, except galvanized (if used), shall be cleaned and a zinc-phosphate (outdoor equipment) or iron phosphate (indoor equipment) pre-treatment applied prior to paint application.
- E. Paint color shall be white; TGIC polyester powder, applied electrostatically through air. Following paint application, parts shall be baked to produce a hard durable finish. The average thickness of the paint film shall be 2.0 mils. Paint film shall be uniform in color and free from blisters, sags, flaking and peeling.
- F. Salt spray withstand tests in accordance with ASTM #D-1654 and #B-117 shall be performed on a periodic basis to provide conformance with the corrosion resistance standard of at least 2500 hours minimum (outdoor equipment) or 600 hours minimum (indoor equipment).

2.9 ELECTRICAL POWER MANAGEMENT SYSTEM [- NOT USED]

- A. The equipment specified herein shall provide the necessary communications connectivity and functionality of an Electrical Power Management System (EPMS). This shall include, but not be limited, to the following:
1. Communications connectivity using the specified Ethernet network and protocols of the EPMS and related EPMS connected devices and equipment necessary to provide functionality. Devices may be connected through a communications gateway as shown or specified; otherwise Ethernet and protocol connectivity shall be provided within the equipment. Equipment sections with multiple connected devices and assemblies of bolted adjacent bays shall include an internal inter-wired communications network for a singular connection to the EPMS network for power monitoring, equipment status and alarms.
 2. Compliance with Cyber security requirements.
 3. Remote EPMS application functionality for equipment configuration [and operational control]; electrical power monitoring; power quality monitoring, compliance and correction; and alarm monitoring with event log.
 4. Refer to the Electrical Power Management System specification section for additional requirements.
- B. Native software compatibility shall be fully factory-tested, and shall include the following characteristics.
1. Capability for pre-engineered, interactive graphical display screens to view and analyze real-time device data. Data displayed shall include the following:
 2. Pre-mapping of registers to standard measurement names without the need for additional configuration or internal device registers.
 3. Automatic collection and logging of device data by EPMS software without additional configuration. Historical data logged shall include the following.

2.10 MARKINGS AND LABELING

- A. All identification and warning labels and nameplates exterior to the SWGR shall be resistant to their intended installation environment.
- B. Each SWGR lineup shall be provided with an engraved nameplate identifying the project specific equipment tag and service description.
- C. Warning labels and nameplates shall be present at access locations to advise personnel of possible hazards. The SWGR shall be marked in accordance with UL, NFPA 70 NEC, NFPA 70E, and other applicable standards.
- D. Each SWGR and cubical shall be identified with an engraved nameplate using 1/2-inch high lettering. Each enclosure mounted control and pilot device shall be identified with an engraved nameplate using 3/8-inch high lettering. Nameplate lettering shall be [all capitals,][all capitals except for math or empirical formulas,] black on a white background. [Equipment designated as safety or emergency related shall have white on red background nameplates.]

PART 3 - EXECUTION

3.1 GENERAL

- A. In addition to the requirements specified herein, execution shall be in accordance with the requirements of Specification Section [26 00 10][16010] and Drawings.

- B. Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.
- C. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
- D. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.
- E. Install equipment in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.
- F. Functional testing, commissioning, and first parameter adjusting shall be carried out by a factory trained manufacturer's representative field service engineer. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment. Report to the Engineer any discrepancies or issues with the installation.
- G. Provide final protection and maintain conditions in a manner acceptable to the manufacturer that shall help ensure that the equipment is without damage at time of Substantial Completion.

3.2 **INSTALLATION [- NOT USED]**

- A. Configuration and Startup: Provide the services of a qualified factory-trained manufacturer's representative to assist the installing contractor with the installation, configuration and startup of the MV SWGR and components. The manufacturer's representative shall inspect the installation of each switchgear and components prior to energizing and configure each component for operation under the specified conditions. The manufacturer's representative shall conduct the initial energization, startup and operation. The manufacturer's representative shall revisit the project site as often as necessary to ensure that all issues are corrected and that the installation and operation are satisfactory.
- B. Certification: The Contractor shall submit a written report certifying that the equipment has been installed, configured, and tested under load in accordance with the manufacturer's recommendations. This report shall be signed by a factory-trained manufacturer's representative and shall include a listing of all modifications and adjustments made onsite to include any settings / parameters not identified as factory defaults within the equipment's O&M documentation.

3.3 **TRAINING [- NOT USED]**

- A. The services of a factory-trained instructor shall be provided for training the Owner's staff in the proper operation and maintenance of the medium voltage metal-enclosed switchgear with vacuum circuit breaker and components. Training shall consist of not less than [1][2 repeated] session(s) with [6][4][2] hours of onsite classroom and hands-on instruction for a minimum of [4] attendees per session. The instructor shall provide sufficient time and detail in each session to cover the following as a minimum:
 1. Theory of operation
 2. Operation of switchgear and components furnished
 3. Maintenance and configuration
 4. Configurations of switchgear and components furnished
 5. Troubleshooting and repair
 6. Replacement of component level parts

3.4 TESTING AND COMMISSIONING [- NOT USED]

- A. Switchgear and related equipment shall be commissioned in accordance with Specification [Section 26 08 00—Commissioning of Electrical Systems][Section 16080—Commissioning of Electrical Systems].
- B. Equipment shall be tested as a system for conformance to specification requirements prior to scheduling the acceptance tests. Contractor shall conduct performance verification tests in the presence of Owner's representative, observing and documenting complete compliance of the system to the specifications. Contractor shall submit a signed copy of the test results, certifying proper system operation before scheduling tests.

END OF SECTION [26 13 23.17]

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