Part 1 General

1.1 RELATED WORK

.1 26 05 00 - Common Work Results for Electrical: Product Data; Delivery, Storage and Handling.

1.2 REFERENCES

.1 The applicable portions of ANSI C57.12.28, covering enclosure integrity for pad-mounted equipment.

.2 The applicable portions of ANSI C37.71, ANSI C37.72, ANSI C37.73, IEC 56, and IEC 265-1 (Class A), which specify test procedures and sequences for the load-interrupter switches, fault interrupters, and the complete switchgear assembly.

.3 ANSI/IEEE 386-2016, Separable Insulated Connector Systems for Power Distribution Systems above 600V.

1.3 SOURCE QUALITY CONTROL

.1 Submit to Engineer standard factory test certificates of each equipment and type test of each equipment with accessories.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 013300 - Submittal Procedures.

.2 Indicate:

.1 Anchoring method and dimensioned foundation template.

.2 Dimensioned cable entry locations.

.3 Dimensioned cable termination height.

.4 Identified internal and external component layout on assembly drawing.

.5 Catalog data on all devices including switches, interlocks, fuses, fuse mounting methods, bushing wells, bushing inserts, spades, separable connectors, etc.

.3 Submit fuse time-current characteristics.

.4 Factory Tests: Furnish manufacturer's certified standard test reports for equipment.

.5 Instruction Manuals: Furnish manufacturer's installation and maintenance manuals on the equipment and accessories.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for equipment for incorporation into manual specified in Section 017800 - Closeout Submittals.

1.6 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 017800 - Closeout Submittals.

.2 Include:

.1 3 spare fuse refills (where applicable).
.2 2 penta-head sockets
.3 1 motorized remote battery powered operator.

Part 2 Products

2.1 PAD MOUNTED SF6 / 3M Novec 4710 SWITCHGEAR

.1 General Description

.1 The switchgear shall consist of a gas-tight tank containing SF6 or 3M Novec 4710 gas, load-interrupter switches and resettable fault interrupters with visible open gaps and integral visible grounds, and a microprocessor-based overcurrent control.
.2 Load-interrupter switch terminals shall be equipped with bushings rated 600amperes continuous
.3 Fault-interrupter terminals shall be equipped with bushings rated 200 amperes continuous to provide for elbow connection.
.4 Manual operating mechanisms and viewing windows shall be located on the opposite side of the tank from the bushings and bushing wells, so that operating personnel shall not be required to perform any routine operations in close proximity to high-voltage elbows and cables.

.2 The ratings for the integrated switchgear shall be as designated below:

.1 Frequency: 60Hz
.2 Short-Circuit Current, Amperes, RMS, Symmetrical: 12.5kA
.3 Voltage Class, kV: 25kV
.1 Maximum Voltage, 27 kV
.2 BIL Voltage, 95 kV
.4 Main Bus Continuous Current, Amperes: 600A
.5 Three-Pole Load-Interrupter Switches
.1 Continuous Current, Amperes: 600A
.2 Load Dropping Current, Amperes: 600A
.3 Fault Closing Current, Duty-Cycle
.1 Three-Time, Amperes, RMS, Symmetrical: 16kA
.2 Three-Time, Amperes, Peak: 41.6kA
.3 Ten-Time, Amperes, RMS, Symmetrical: 16kA
.4 Ten-Time, Amperes, Peak: 41.6kA
.6 Fault Interrupters
.1 Continuous Current, Amperes: 200A
.2 Load Dropping Current, Amperes: 200A
.3 Fault Interrupting Current, Duty-Cycle
.1 Three-Time, Amperes, RMS, Symmetrical: 12.5kA
.2 Ten-Time, Amperes, RMS, Symmetrical: 12.5kA
.4 Fault Closing Current, Duty-Cycle
.1 Three-Time, Amperes, RMS, Symmetrical: 12.5kA
.2 Three-Time, Amperes, Peak: 32kA
.3 Ten-Time, Amperes, RMS, Symmetrical: 12.5kA
.4 Ten-Time, Amperes, Peak: 32.5kA

.3 GAS INSULATION

.1 The switchgear shall be filled with SF6 gas or 3M Novec 4710 gas in accordance with manufacturer's instructions.

.2 The gas-tight tank shall be evacuated prior to filling with insulating gas to minimize moisture in the tank.

.3 The switchgear shall withstand system voltage at a gas pressure of 0 psig at 68º F.

.4 A gas-fill valve shall be provided.

.5 A temperature-compensated pressure gauge shall be provided that is color coded to show the operating range. The gauge shall be mounted inside the gas-tight tank (visible through a large viewing window) to provide consistent pressure readings regardless of the temperature or altitude at the installation site.

.4 GAS TANK

.1 The tank shall be submersible and able to withstand up to 10 feet of water over the base.

.2 The tank shall be of welded construction and shall be made of Type 304L stainless steel.

.3 A means of lifting the tank shall be provided.

.5 HIGH-VOLTAGE BUS

.1 Bus and interconnections shall withstand the stresses associated with short-circuit currents up through the maximum rating of the switchgear.

.2 Before installation of aluminum bus, all electrical contact surfaces shall first be prepared by machine-abrading to remove any oxide film. Immediately after this operation, the electrical contact surfaces shall be coated with a uniform coating of an oxide inhibitor and sealant.

.6 PROVISIONS FOR GROUNDING

.1 One ground-connection pad shall be provided on the gas-tight tank of the switchgear.

.2 The ground-connection pad shall be constructed of stainless steel and welded to the gas-tight tank, and shall have a short-circuit rating equal to that of the switchgear.

.3 When an enclosure is provided, no less than one enclosure ground pad shall be provided.

.4 Provide one ground-connection pad per way.

.7 CONNECTIONS

.1 Load-interrupter switches shall be equipped with 600-ampere bushings, and fault interrupters shall be equipped with 200-ampere bushing wells.

.2 Bushings and bushing wells shall be located on one side of the gear to reduce the required operating clearance.

.3 Bushings rated 600 amperes continuous shall be provided without a threaded stud.

.4 For gear rated 12.5 kA only, the following optional features should be specified as required:

.1 Fault interrupters shall be equipped with 600-ampere bushings.

.2 Load-interrupter switches shall be equipped with 200-ampere bushing wells.

.8 BUSHINGS AND BUSHING WELLS

.1 Bushings and bushing wells shall conform to ANSI/IEEE Standard 386.

.2 Bushings and bushing wells shall include a semi-conductive coating.

.3 Bushings and bushing wells shall be mounted in such a way that the semi-conductive coating is solidly grounded to the gas-tight tank.

.9 VIEWING WINDOWS

.1 Each load-interrupter switch shall be provided with a large viewing window at least 6 inches by 12 inches to allow visual verification of the switch-blade position (closed, open, and grounded) while shining a flashlight on the blades.

.2 Each fault interrupter shall be provided with a large viewing window at least 6 inches by 12 inches to allow visual verification of the disconnect-blade position (closed, open, and grounded) while shining a flashlight on the blades.

.3 Viewing windows shall be located on the opposite side of the gear from the bushings and bushing wells so that operating personnel shall not be required to perform any routine operations in close proximity to high-voltage elbows and cables.

.4 A cover shall be provided for each viewing window to prevent operating personnel from viewing the flash which may occur during switching operations.

.10 LOAD-INTERRUPTER SWITCHES

.1 The three-phase, group-operated load-interrupter switches shall have a three-time and ten-time duty-cycle fault-closing rating as specified under "Ratings." This rating defines the ability to close the switch the designated number of times against a three-phase fault with asymmetrical (peak) current in at least one phase equal to the rated value, with the switch remaining operable and able to carry and interrupt rated current.

.2 The switch shall be provided with an integral ground position that is readily visible through the viewing window to eliminate the need for cable handling and exposure to high voltage to ground the equipment.

.3 The ground position shall have a three-time and ten-time duty-cycle fault-closing rating.

.4 The switch shall be provided with an open position that is readily visible through the viewing window to eliminate the need for cable handling and exposure to high voltage to establish a visible gap.

.5 The open gaps of the switch shall be sized to allow cable testing through a feed thru bushing or the back of the elbow.

.11 FAULT INTERRUPTERS

.1 Fault interrupters shall have a three-time and ten-time duty-cycle fault-closing and fault interrupting rating as specified under "Ratings." This rating defines the fault interrupter's ability to close the designated number of times against a three-phase fault with asymmetrical (peak) current in at least one phase equal to the rated value and clear the resulting fault current, with the interrupter remaining operable and able to carry and interrupt rated current.

.2 The fault interrupter shall be provided with a disconnect with an integral ground position that is readily visible through the viewing window to eliminate the need for cable handling and exposure to high voltage to ground the equipment.

.3 The ground position shall have a three-time and ten-time duty-cycle fault-closing rating.

.4 The disconnect shall be provided with an open position that is readily visible through the viewing window, eliminating the need for cable handling and exposure to high voltage to establish a visible gap.

.5 The fault interrupter, including its three-position disconnect, shall be a single integrated design so that operation between the closed and open positions or the open and grounded positions is accomplished with a single, intuitive movement.

.6 The open gaps of the disconnect shall be sized to allow cable testing through a feed through bushing or the back of the elbow.

.7 An internal indicator shall be provided for each fault interrupter to show when it is in the tripped condition. The indicator shall be clearly visible through the viewing window.

.12 OPERATING MECHANISMS

.1 Load-interrupter switches and fault interrupters shall be operated by means of a quick-make, quick-break mechanism.

.2 The manual handle shall charge the operating mechanism for closing, opening, and grounding of the switches and fault interrupters.

.3 A single, integrated operating mechanism shall fully operate each fault interrupter or load interrupter switch in a continuous movement, so that additional operations are not required to establish open or grounded positions.

.4 Operating mechanisms shall be equipped with an operation selector to prevent inadvertent operation from the closed position directly to the grounded position, or from the grounded position directly to the closed position. The operation selector shall require physical movement to the proper position to permit the next operation.

.5 Operating shafts shall be pad lockable in any position to prevent operation.

.6 The operation selector shall be pad lockable to prevent operation to the grounded position.

.7 The operating mechanism shall indicate switch position which shall be clearly visible from the normal operating position.

.13 OVERCURRENT CONTROL

.1 A microprocessor-based overcurrent control shall be provided to initiate fault interruption.

.2 For dry-vault-mounted style and pad-mounted style switchgear, the control shall be mounted in a watertight enclosure. For under-ground style and wet-vault-mounted style switchgear, the control shall be mounted in a submersible enclosure. The control shall be removable in the field without taking the gear out of service.

.3 Control settings shall be field-programmable using a personal computer connected via a data port to the control. The data port shall be accessible from the exterior of the enclosure. Neither external power nor energization of the gear shall be required to set or alter control settings.

.4 Power and sensing for the control shall be supplied by integral current transformers.

.5 The minimum total clearing time (from initiation of the fault to total clearing) for fault interruption shall be 40 milliseconds (2.4 cycles) at 60 hertz or 44 milliseconds (2.2 cycles) at 50 hertz.

.6 The control shall feature time-current characteristic (TCC) curves including standard E speed, K-speed, coordinating-speed tap, coordinating-speed main, and relay curves per IEEE C37.112. Coordinating-speed tap curves shall optimize coordination with load-side weak-link/backup current-limiting fuse combinations, and coordinating-speed main curves shall optimize coordination with tap-interrupter curves and upstream feeder breakers.

.7 Event records shall be easily extractable from the control using a personal computer connected to the data port.

.14 SWITCHGEAR STYLE – PAD-MOUNTED STYLE

.1 The gas-tight tank shall be made of 7-gauge mild-steel.

.2 The following optional feature should be specified as required:

.1 To guard against corrosion due to extremely harsh environmental conditions, the gas-tight tank shall be made of Type 304L stainless steel.

.2 The switchgear shall conform to or exceed the requirements of applicable portions of IEC 298, Appendix AA covering arc resistance, through 12.5 kA for 15 cycles.

.3 Enclosure

.1 The switchgear shall be provided with a pad-mounted enclosure suitable for installation of the gear on a concrete pad or engineered fiberglass pad.

.2 The pad-mounted enclosure shall be separable from the switchgear to allow clear access to the bushings and bushing wells for cable termination.

.3 The basic material shall be 14-gauge hot-rolled, pickled and oiled steel sheet.

.4 The enclosure shall be provided with removable front and back panels, and hinged lift-up roof sections for access to the operating and termination compartments. Each roof section shall have a retainer to hold it in the open position.

.5 Lift-up roof sections shall overlap the panels and shall have provisions for pad-locking that incorporate a means to protect the padlock shackle from tampering.

.6 The base shall consist of continuous 90-degree flanges, turned inward and welded at the corners, for bolting to the concrete pad.

.7 Panel openings shall have 90-degree flanges, facing outward, that shall provide strength and rigidity as well as deep overlapping between panels and panel openings to guard against water entry.

.8 For bushings rated 600 amperes continuous, the termination compartment shall be of an adequate depth to accommodate encapsulated surge arresters mounted on 600-ampere elbows having 200-ampere interfaces.

.9 For bushing wells rated 200 amperes continuous, the termination compartment shall be of an adequate depth to accommodate 200-ampere elbows mounted on feed through inserts.

.10 An instruction manual holder shall be provided.

.11 Non-removable lifting tabs shall be provided.

.4 Enclosure Finish

.1 All exterior welded seams shall be filled and sanded smooth for neat appearance.

.2 To remove oils and dirt, to form a chemically and anodically neutral conversion coating to improve the finish-to-metal bond, and to retard under film propagation of corrosion, all surfaces shall undergo a thorough pretreatment process comprised of a fully automated system of cleaning, rinsing, phosphatizing, sealing, drying, and cooling, before any protective coatings are applied. By utilizing an automated pretreatment process, the enclosure shall receive a highly consistent thorough treatment, eliminating fluctuations in reaction time, reaction temperature, and chemical concentrations.

.3 After pretreatment, protective coatings shall be applied that shall help resist corrosion and protect the steel enclosure. To establish the

capability to resist corrosion and protect the enclosure, representative test specimens coated by the manufacturer's finishing system shall satisfactorily pass the following tests:

.1 4000 hours of exposure to salt-spray testing per ASTM B 117 with:

.1 Under film corrosion not to extend more than 1/32 in. from the scribe, as evaluated per ASTM D 1645, Procedure A, Method 2 (scraping); and

.2 Loss of adhesion from bare metal not to extend more than 1/8 in. from the scribe.

.2 1000 hours of humidity testing per ASTM D 4585 using the Cleveland Condensing Type Humidity Cabinet, with no blistering as evaluated per ASTM D 714.

.3 500 hours of accelerated weathering testing per ASTM G 53 using lamp UVB-313, with no chalking as evaluated per ASTM D 659, and no more than 10% reduction of gloss as evaluated per ASTM D 523.

.4 Crosshatch-adhesion testing per ASTM D 3359 Method B, with no loss of finish.

.5 160-inch-pound impact, followed by adhesion testing per ASTM D 2794, with no chipping or cracking.

.6 3000 cycles of abrasion testing per ASTM 4060, with no penetration to the substrate. Certified test abstracts substantiating the above capabilities shall be furnished upon request.

.4 The finish shall be inspected for scuffs and scratches. Blemishes shall be touched up by hand to restore the protective integrity of the finish.

.5 The finish shall be olive green, Munsell 7GY3.29/1.5.

.15 Optional Features

.1 A portable remote-control device shall be provided which plugs into an adapter on the face of the motor control board and allows the user to activate the motor operator at a maximum distance of 50 feet from the gear.

.16 LABELING

.1 Hazard-Alerting Signs

.1 The exterior of the pad-mounted enclosure shall be provided with "Warning-Keep Out-Hazardous Voltage Inside-Can Shock, Burn, or Cause Death" signs.

.2 Each unit of switchgear shall be provided with a "Danger-Hazardous Voltage-Failure to Follow These Instructions Will Likely Cause Shock, Burns, or Death" sign. The text shall further indicate that operating personnel must know and obey the employer's work rules, know the hazards involved, and use proper protective equipment and tools to work on this equipment.

.3 Each unit of switchgear shall be provided with a "Danger-Keep Away-Hazardous Voltage-Will Shock, Burn, or Cause Death" sign.

.2 Nameplates, Ratings Labels, and Connection Diagrams

.1 Each unit of switchgear shall be provided with a nameplate indicating the manufacturer's name, catalog number, model number, date of manufacture, and serial number.

.2 Each unit of switchgear shall be provided with a ratings label indicating the following: voltage rating; main bus continuous current rating; short-

circuit rating; fault-interrupter ratings including interrupting and duty-cycle fault-closing; and load-interrupter switch ratings including duty-cycle fault-closing and short-time.

.17 ACCESSORIES

.1 A USB cable kit shall be provided for connecting an overcurrent control to a user-furnished personal computer.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 260500 - Electrical General Requirements.

.2 Include permanent nameplates including manufacturer's name, catalog number, model number, date of manufacture, and serial number, and main electrical ratings.

Part 3 Execution

3.1 INSTALLATION

.1 Ensure precast concrete foundation is properly installed, engineered fiberglass foundation is properly installed, or concrete pad is fully cured before equipment is installed.

.2 Set and secure equipment unit in place, rigid, plumb and square.

.3 Make all cable connections.

.4 Connect equipment ground bus to system ground.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 260500 - Electrical General Requirements and Section 260510 - Electrical Testing.

.2 Inspect all connections for tightness and for signs of overheating.

.3 Inspect and clean insulators and enclosure.

.4 Check trip unit settings for correctness of type and size.

END OF SECTION