Trayer

SERIES 3805 / 3815 SPECIFICATION

15KV & 25KV PADMOUNTED LIQUID-INSULATED VACUUM LOAD INTERRUPTERS AND VACUUM FAULT INTERRUPTERS

MANUALLY OPERATED / REMOTELY OPERATED
DEAD FRONT PADMOUNTED SWITCHGEAR
WITH VACUUM LOAD-INTERRUPTING SWITCHES
AND VACUUM FAULT INTERRUPTERS

FOR USE WITH SEPARABLE CONNECTORS FOR
15KV / 95KV BIL AND 25KV / 125KV BIL THREE-PHASE
ALTERNATING-CURRENT SYSTEMS

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1. Scope

This specification applies to liquid-insulated 15kV and 25kV 60Hz class three-phase gang operated padmounted load interrupting and vacuum fault interrupting assemblies with maximum continuous ratings of 600A for use on underground distribution systems utilizing dead front equipment.

2. Definitions

The definitions of terms contained in this specification, or in other standards referred to in this document, are not intended to embrace all the legitimate meanings of the terms. They are applicable only to the subject treated in this specification. Any documents or industry standards referred to shall be of the latest revision.

2.1 ASTM
American Society for Testing and Materials

2.2 ANSI
American National Standards Institute

2.3 IEEE
Institute of Electrical and Electronic Engineers

2.4 NEMA
National Electrical Manufacturers Association

2.5 IEC
International Electrotechnical Commission

2.6 AISI
American Iron and Steel Institute

2.7 Bus (As used in this specification)

A three-phase junction common to two or more ways

2.8 Dead Front Padmounted Switchgear

An assembly in which all energized parts are insulated and completely enclosed within a grounded shield system when separable connectors are in place

2.9 Way

A three-phase circuit entrance to a switching assembly

2.10 Switched Way

A way connected to the bus through a three-pole gang operated switch

2.11 Tapped Way

A way solidly connected to the bus

2.12 VFI Way

A way connected to the bus through a three-pole gang operated vacuum fault interrupter

3. Construction Requirements

3.1 Electrical

3.1.1 The switchgear shall be of total dead front design. All energized parts shall be sealed behind a welded ground plane to avoid the possibility of exposure to electrical shock when separable connectors are in place.

3.1.2 The load interrupter switch shall be a three-phase gang operated device of a quick-make, quick-break design that operates at a speed independent of the speed of the external operating handle and shall utilize vacuum contacts rated at 600A continuous and 20,000A asymmetrical momentary. The mechanism shall have a minimum life of 10,000 operations at a full 600A load without the need for service, replacements, or adjustments.

3.1.3 The fault interrupters shall be a three-phase gang operated device of a quick-make, quick-break design that operates at a speed independent of the speed of the external operating handle and shall utilize vacuum contacts rated 600A continuous, 12,500A RMS symmetrical fault interrupting, 20,000A asymmetrical momentary, and shall have a minimum life of 8,000 load break operations at a full 600A load without the need for service, replacements, or adjustment. The fault interrupter trip mechanism shall be solenoid actuated and shall have capacitor energy storage devices to provide trip power.

3.1.4 The visible disconnect device, when installed, shall be a three-phase two position gang operated open-blade switch device of a quick-make, quick-break design that operates at a speed independent of the speed of the external operating handle and shall be rated at 600A continuous and 20,000A asymmetrical momentary, to be used in series with a fault interrupter switch or a load interrupter switch to establish a visible open on the circuit. The contacts of the visible disconnect device shall be clearly visible in the open and closed positions through a window located on the tank face adjacent to the operating handles. The operating handle of the visible disconnect device shall be externally interlocked with the operating handle of the fault interrupter or load interrupter in such a manner as to prevent the visible disconnect device from performing load break operations. The interlock shall be clearly visible to the operator for the purpose of confirming proper operation.

3.1.5 All internal bus shall be of copper bar or copper ribbon; no braid shall be used and no aluminum shall be used. All internal electrical clearances shall be a minimum of 2” to maintain a 125kV BIL rating for the bus work. All connections shall be double nut secured to maintain connection integrity.

3.1.6 All wire penetrations into the switch tank shall be grouped and potted in a liquid-tight synthetic dielectric compound and the potted group shall be o-ring sealed to the tank.

3.1.7 Control power for operating relays, charging capacitor trip modules, and charging backup power capacitors shall be provided by an internally mounted and fuse protected potential transformer bussed to the common bus such that no external power supply is required once the source-side cables are energized. The potential transformer fuse shall be mounted internally and shall have an externally available disconnect switch for the purpose of high voltage testing of the switchgear

3.1.8 All electronic controls, relays, capacitor trip modules, and backup power capacitors shall be housed in a stainless steel enclosure outside and separate from the switch tank and the high voltage cable compartment.

3.1.9 Capacitor discharge switches shall be included on all capacitor trip modules and backup power capacitors to allow safe inspection and maintenance inside a stainless steel relay/control enclosure.

3.2 Overcurrent Relays

The overcurrent relays shall be Schweitzer No. 501-2 with the capability to:

3.2.1 Provide both phase and residual overcurrent protection with inverse, very inverse, or extremely inverse curves all available in the one relay. All applicable IEC and ANSI curves are preprogrammed into the relay and any custom curve can be added.

3.2.2 Provide monitoring of load with instantaneous and demand currents with 2% accuracy at nominal input.

3.2.3 A count of trip operations and accumulation of interrupter current on a pole-by-pole basis.

3.2.4 Have a time delay on pick-ups adjustable from 0-16,000 cycles to help in coordination and also in cold load pick-up situations.

3.2.5 Make a 15-cycle event report for each time the relay picks up on fault. The report to contain detailed current, relay element, and input and output data associated with the event.

3.2.6 The relay to store summaries of the 20 latest events and full length reports for the 12 latest events.

3.2.7 Provide interface with future SCADA remote terminal units.

3.2.8 Protect from unauthorized relay setting changes with a pass-code system.

3.3 Ratings

Ratings for the Unit/System Voltage				
Nominal Voltage (Series)	15kV (3805)		25kV (3815)	
Maximum Design Voltage	15.5kV		27kV	
Device	Load Break Switch	Vacuum Fault Interrupter	Load Break Switch	Vacuum Fault Interrupter
BIL Phase-to-Phase, Phase-to-Ground	95kV	95kV	125kV	125kV
BIL Across Open Contacts	95kV	95kV	150kV	125kV
One Minute Withstand (60Hz)	34kV	34kV	40kV	40kV
Continuous Current	600A	600A	600A	600A
Load Switching	600A	600A	600A	600A
Load Break Operations at Full Load	10,000	8,000	10,000	8,000
Maximum Interrupting Current (Symmetrical)	N/A	12.5kA	N/A	12.5kA
Number of Fault Interruptions at 12.5kA	N/A	65	N/A	65
Maximum Emergency Three-Time Interrupting	2000A	N/A	2000A	N/A
Momentary & Make and Latch				
600A ways (Asymmetrical)	20kA	20kA	20kA	20kA
200A ways (Asymmetrical)	15kA	15kA	15kA	15kA

N/A = Not Applicable

3.4 Tank Construction

3.4.1 The entire assembly shall be constructed of AISI type 304 stainless steel and shall be fully welded using AISI type 308 filler material to maintain the corrosion resistant properties. No bolted/gasketed tank construction shall be allowed.

3.4.2 The tank body shall be constructed with a minimum material thickness of AISI 7 ga.

3.4.3 All bushings and bushing wells to be welded to make them an integral part of the tank. No bolted/gasketed bushings shall be allowed.

3.4.4 Bushings shall be arranged horizontally to allow for easy cable training while maintaining a minimum 8” spacing between bushings.

3.4.5 The entire switch tank shall be hermetically sealed and be fully submersible with all tank penetrations being double o-ring sealed.

3.4.6 No external portion of the tank or its accessories shall trap water.

3.4.7 Lifting lugs shall be welded to the tank so that the switch will remain level when being lifted. Lifting lugs shall have a rounded contour to limit damage to lifting slings.

3.4.8 Parking stands shall be provided and located to allow each way to be parked with a minimum elbow and cable movement distance (for parking stand dimensions see ANSI C57.12.26-1975, Fig 5[2]).

3.4.9 One grounding provision with a 1/2″ 13 NC stainless steel nut, 7/16″ (11.1mm) deep, shall be provided for each way and shall be located to allow easy access for grounding each way. The grounding provision shall be welded to the switch tank.

3.5 Enclosure Construction

3.5.1 The front and rear enclosures shall be constructed of AISI type 304 stainless steel and shall be welded using AISI type 308 filler material to maintain the corrosion resistant properties.

3.5.2 The enclosures shall be available as either three-door cabinets or hoods and bases. The cabinet enclosure bodies and doors shall be constructed of a minimum material thickness of AISI 11ga. Lift-up lids shall be of a minimum material thickness of AISI 14ga. Enclosure bases shall be constructed of a minimum material thickness of ANSI 11ga. and hoods shall be of a minimum thickness material of ANSI 14ga.

3.5.3 The cabinet enclosures shall have double doors and lift-up lids. All doors shall have provisions to latch the doors in the open position to prevent unintentional closing; the lids shall have self-setting latches that hold the lid open until manually unlocked. The right-hand door shall have a three-point locking system with padlock provisions on the operating handle. Hood and base enclosures shall have a hood hung from three hinges and having an automatically deploying wind-latch to prevent unintentional closing and two handles for lifting. The hood shall integrate with the base and have padlock provisions. The hoods and bases shall be easily removed for access to the cableways or for replacement.

3.5.4 The enclosure doors shall interlock with the lift-up lid and hoods shall interlock with bases. Both shall include a fully encased and padlockable pentahead security bolt.

3.5.5 No external portion of the enclosure or its accessories shall trap water.

3.6 Paint

Because of the corrosion resistant nature of AISI type 304 stainless steel, only the outside of the enclosure will be painted. Paint processes shall meet or exceed ANSI std. C57.12.28. Color shall be Munsell 7GY 3.29/1.5 Padmount Green unless otherwise specified.

4. Dielectric

4.1 Unit shall utilize a liquid dielectric to insulate all internal components. Load and fault interruption shall take place in sealed vacuum contact bottles to protect the liquid insulation from exposure to arcing during load or fault interruption.

4.2 Provisions for adding liquid insulation shall be provided by means of a 1"NPT fill port located on the front face of the unit within the high-voltage compartment and provisions for draining or sampling shall be made available as an optional feature.

4.3 A liquid level indicating device shall be provided to positively identify a low liquid level condition. This device shall display, in white letters on a red background, the words "LOW OIL" when the liquid level drops below prescribed limits. This device shall be static with no moving parts and shall be unaffected by the environmental conditions for the life of the switchgear assembly.

5. Manual Operating Provisions

5.1 Manual operating handles shall move in to close and out to open. The direction of operation shall be apparent.

5.2 Switch, VFI, and visible disconnect device operating handles shall be designed to be easily operated with standard live line tools. The handles shall be of a channel shape and formed from AISI type 304 stainless steel, with the lower edge of sufficient width to support the hook end of standard live line tools, and assist in guiding the hook into the handle opening for live line tool operation. They shall be located where they can be operated either to open or to closed positions with standard live-line tools. The force required to operate the handle shall be such that one average strength person in a standing position can readily operate it.

5.3 Switch, VFI, and visible disconnect operating handles shall be capable of being padlocked in both the open and closed positions, and shall be labeled to clearly indicate switch position.

6. Load Break Switch, Fault Interrupter, and Visible Disconnect Switch Operating Mechanism

6.1 The switch, fault interrupter, and visible disconnect switch mechanism shall be designed so that operation does not require any special skills, and the closing and opening speeds of the contacts are independent of the speed at which the operating handle is operated.

6.2 The switch, fault interrupter, and visible disconnect switch shall be of a gang operated, three-phase design so that all contacts of the three phases shall be operated simultaneously with no possibility of single phasing due to teasing of switch handle.

6.3 The switch, fault interrupter, and visible disconnect switch shall be quick-make, quick-break type. Contacts shall be stable in open and closed positions without use of mechanical latches, sear pins, or detents.

6.4 The fault interrupter mechanism shall be a true trip-free device. The trip mechanism shall reset and be trip-ready when the fault interrupters operating handle is moved to the open position. The trip mechanism shall function independently of the fault interrupters contact opening/closing mechanism such that if the device is closed into a fault the device will trip open and the tripping action will not be felt in the operating handle.

7. Position Indicators

7.1 Switch, fault interrupter, and visible disconnect switch handles shall act as position indicators that clearly and positively indicate the open and closed positions of the switch mechanisms. Nameplates of a corrosion resistant material shall be fixed to the switch tank adjacent to the operating handle to assist in identifying switch position.

7.2 Visible disconnect switch contact positions shall be clearly visible though a viewing window located near the operating handle.

7.3 Fault interrupters shall have an additional indicator to show a tripped condition. The indicator shall be of a mechanical design linked directly to the trip mechanism of the fault interrupter. Electronic or electrical devices will not be used. The indicator shall consist of a yellow indicator rod within a clear sight glass mounted adjacent to the fault interrupter's operating handle. The indicator shall be up within the sight glass and clearly visible during a tripped condition of the fault interrupter, and down, out of the sight glass, and concealed during a trip-ready condition of the fault interrupter.

8. Motor Operating Provisions

Provisions for motor operators shall be standard and supplied with every unit.

9. Terminations

The switch bushings shall accommodate cable terminations in accordance with ANSI/IEEE std. 386-1977.

10. Bushing Designation

The switch bushings shall be identified and legibly marked adjacent to each bushing with the appropriate phase designation, using a nameplate of stainless steel or other corrosion resistant material.

11. Nameplate

11.1 A nameplate of stainless steel shall be provided.

11.2 The nameplate shall be securely welded to the tank.

11.3 All letters, schematics, and numbers shall be photo engraved or stamped on the nameplate.

11.4 The nameplate shall contain at least the following information:

11.4.1 Name of manufacturer

11.4.2 Date of manufacture (month and year, for example, 1-90)

11.4.3 Serial number

11.4.4 Model or style number

11.4.5 Rated maximum voltage

11.4.6 Rated impulse withstand voltage

11.4.7 Rated continuous current

11.4.8 Rated load interrupting current

11.4.9 Rated momentary current

11.4.10 Rated making current

11.4.11 A three-line bushing-oriented schematic diagram, using standard symbols (this may be put on a separate nameplate)

11.4.12 Total weight (including insulating medium)

11.4.13 Type of insulating medium

12. Testing Requirements

12.1 Tank

The finished tank will be pressurized to 7 pounds per square inch using dry nitrogen and tested for leaks using suitable leak detection methodology.

12.2 Electrical

12.2.1 AC hi-pot for 1 minute phase-to-phase, phase-to-ground, and across open contacts on all ways at 34kV for 15kV equipment and 40kV for 25kV equipment.

12.2.2 Continuity test all circuits

12.2.3 Resistance test all circuits using 100 amps

12.2.4 Test reports certifying the vacuum switch conforms to ANSI C37.72 Test Sequence Paragraph 5.1.5 shall be submitted.

13. Shipping Requirements

13.1 The switch shall be completely assembled, including the correct amount of insulating fluid.

13.2 Switches shall be properly packaged and braced to prevent damage during shipment.

14. Documentation

Instructions and checklists for the inspection, installation, and maintenance of the switch shall be provided.