100 / 110 BSF
SPECIFICATION

15KV & 25KV SUBMERSIBLE VACUUM LOAD INTERRUPTERS AND FUSE ASSEMBLIES FOR HIGH FAULT CURRENT APPLICATIONS

MANUALLY OPERATED / REMOTELY OPERATED
SUBMERSIBLE SWITCHGEAR
WITH LOAD INTERRUPTING SWITCHES AND LIQUID IMMERSED FUSES

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 submersible load interrupting switches with maximum continuous ratings of 600A and liquid immersed fuse assemblies with maximum continuous ratings of 200A 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 Way
A three-phase circuit entrance to a switching assembly

2.9 Switched Way
A way connected to the bus through a three-pole, group operated switch

2.10 Tapped Way
A way solidly connected to the bus

2.11 Fused Way
A way connected to the bus through a liquid immersed fuse assembly

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 fuse holders shall be liquid immersed holders mounted individually or in groups of two or three. The fuse holder shall be capable of accepting fuses from any US manufacturer intended for liquid immersion up to and including 200A capacity. Fuse specific adapters will be allowed. Full-range current limiting fuses, Combined Technologies (Cooper) type SX Limiter and Trans-Guard SX (KHT) are Trayer recommended. ***Note:*** *The use of expulsion type fuse assemblies requires that the dielectric fluid be tested for contamination and dielectric strength after each fuse operation. After an expulsion cartridge operates, the backup current limiting fuse may only be reused after complete testing per manufacturers' specifications.*

3.1.4 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 150kV BIL rating for the bus work. All connections shall be double nut secured to maintain connection integrity.

3.2 Fusing

3.2.1 Fused ways shall be available in switched configurations only.

3.2.2 The fuse holder shall be designed such that the load-side connection to each holder is at the bottom contact of the fuse. Each fuse will be placed in series with a load break switch such that there is no path through the unit that passes through a loadbreak switch without also passing through a fuse. The switches can be used to deenergize the fuse holder and fuse, which must be done before removing or replacing the fuse.

3.2.3 The fuse cap shall be secured to the tank using eyebolt type locking devices.

3.2.4 Fused ways shall be available in single-, two-phase or three-phase groups.

3.3 Ratings

Ratings for the Unit/System Voltage	15kV	25kV
Nominal Voltage	15kV	25kV
Maximum Design Voltage	15.5kV	27kV
BIL Phase-to-Phase, Phase-to-Ground	95kV	125kV
BIL Across Open Contacts	95kV	150kV
One Minute Withstand (60Hz)	34kV	40kV
Continuous Current	600A	600A
Load Switching	600A	600A
Load Break Operations at Full Load	10,000	10,000
Maximum Interrupting Current (Symmetrical) of a Fused Way (with current limiting fuses)	50kA	50kA
Maximum Three-Time Emergency Interrupting Rating	2000A	2000A
Momentary Make and Latch		
600A ways (Asymmetrical)	20kA	20kA
200A ways (Asymmetrical)	15kA	15kA

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. Bolted/gasketed tank assemblies will not be allowed.

3.4.2 The tank body shall be constructed with a minimum material thickness of AISI 11 ga.

3.4.3 All bushings and bushing wells to be welded to make them an integral part of the tank. Bolted/gasketed bushings or bushing wells shall not be allowed.

3.4.4 Bushings shall be arranged with 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 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 ½″ 13 NC stainless steel nut, 7/16″ (11.1mm) deep, shall be provided for each way and shall be located allowing easy access for grounding each way. The grounding provision shall be welded to the switch tank.

3.4.10 A mounting stand shall be an available option to which the switch shall be bolted. The stand shall elevate the switch to a convenient operating height and shall be of hot-dip galvanized carbon steel or stainless steel.

4. Dielectric

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

4.2 Provisions for adding liquid insulation shall be provided by means of any of the fuse well openings 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 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 operating handles shall be capable of being padlocked in both the open and closed positions and shall be labeled to clearly indicate position.

6. Switch Operating Mechanisms

6.1 The 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 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 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.

7. Position Indicators

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.

8. Motor Operating Provisions

Provisions for motor operators shall be made available as an option for all switched ways.

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 number 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 hipot 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

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.