SERIES 100 / 110 / 120
SPECIFICATION

15kV, 25kV & 35kV SUBMERSIBLE & VAULT MOUNTED VACUUM LOAD INTERRUPTERS

MANUALLY OPERATED / REMOTELY OPERATED
DEAD FRONT SUBMERSIBLE AND VAULT MOUNTED
VACUUM LOAD NTERRUPTING SWITCHGEAR

FOR USE WITH SEPARABLE CONNECTORS FOR
15 kV / 95kV BIL, 25kV / 125KV BIL and 35kV / 150kV BIL
THREE-PHASE ALTERNATING-CURRENT SYSTEMS

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1. Scope

This specification applies to liquid-insulated 15kV, 25kV & 35kV 60Hz class three-phase gang-operated submersible and vault mounted vacuum load 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 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

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 vacuum 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 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 vacuum 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 vacuum load interrupter in such a manner as to prevent the visible disconnect device from performing loadbreak operations The interlock shall be clearly visible to the operator for the purpose of confirming proper operation.

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.

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

3.2 Ratings

Nominal Voltage (Series)	**15kV (100)**	**25kV (110)**	**35kV (120)**
Maximum Design Voltage	15.5kV	27kV	38kV
Device	Load Break Switch	Load Break Switch	Load Break Switch
BIL Phase-to-Phase, Phase-to-Ground	125kV	125kV	150kV
BIL Across Open Contacts	95kV	150kV	150kV
One Minute Withstand (60Hz)	34kV	40kV	50kV
Continuous Current	600A	600A	600A
Load Switching	600A	600A	600A
Load Break Operations at Full Load	10,000	10,000	10,000
Maximum Interrupting Current (Symmetrical)	N/A	N/A	N/A
Number of Fault Interruptions at 12.5kA	N/A	N/A	N/A
Maximum Emergency 3-Time Interrupting	2000A	2000A	2000A
Momentary & Make and Latch			
600A ways (Asymmetrical)	20kA	20kA	20kA
200A ways (Asymmetrical)	15kA	15kA	15kA

N/A = Not Applicable

3.3 Tank Construction

3.3.1 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. Bolted/gasketed viewing windows are acceptable.

3.3.2 The tank body shall be constructed with material thicknesses ranging from AISI 14 ga. to AISI 7 ga. as appropriate depending on the size and configuration of the tank body.

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

3.3.4 Bushings shall be arranged to allow for easy cable training while maintaining a minimum 4" spacing between 200A bushing wells and 5" spacing between 600A bushings.

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

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

3.3.7 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.

3.3.8 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]).

3.3.9 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 Mounting Stand

An optional mounting stand shall be made available 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 a 1" NTP fill port located on the front face (for front operated equipment) or the liquid level gauge port on top of the unit (for top operated equipment) 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 Load break switch 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 Load break switch 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. Loadbreak Switch and Visible Disconnect Switch Operating Mechanism

6.1 The load break switch 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 load break switch 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 load break switch 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.

7. Position Indicators

7.1 Load break switch 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 stainless steel 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.

8. Motor Operating Provisions

Provisions for motor operators shall be made available as an optional feature.

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.

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, 40kV for 25kV equipment and 50kV for 35kV 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.