Solid Dielectric Load Break SPECIFICATION

25kV, 600A, 3 WAYS, 3 WAYS SWITCHED SUBMERSIBLE VACUUM LOAD INTERRUPTER

MANUALLY OPERATED / REMOTELY OPERATED
DEAD FRONT SUBMERSIBLE
VACUUM LOAD INTERRUPTING SWITCHGEAR

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

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1. Scope

This specification applies to solid dielectric insulated 25kV 60Hz class three-phase gang-operated submersible vacuum load interrupting assemblies with continuous ratings of 630 Amps for use on underground distribution systems utilizing dead front equipment.

2. Applicable Standards

The applicable standards for the equipment are:

IEEE Std C37.74-2003
IEEE Standard Requirements for Subsurface, Vault, and Pad-Mounted Load-Interrupter Switchgear and Fused Load-Interrupter Switchgear for Alternating Current Systems Up to 38 kV

IEEE Std C37.100.1-2007
IEEE Standard of Common Requirements for High Voltage Power Switchgear Rated Above 1000V

IEC 62271-103, Ed. 1.0 20011-06
High-voltage switchgear and controlgear - Part 103: Switches for rated voltages above 1 kV up to and including 52 kV

IEC 62271-1, Ed. 1.0, 2007-10
High-voltage switchgear and controlgear - Part 1: Common specifications

IEC 60059 Ed. 2.1, 2009-08
IEC standard current ratings

IEC 60529, Edition 2.1, 2001-02
Degrees of protection provided by enclosures (IP Code)

IEEE Std 386-2006
IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600 V

IEEE Std C37.301-2009
IEEE Standard for High-Voltage Switchgear (Above 1000V) Test Techniques – Partial Discharge Measurements

3. 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.

ASTM
American Society for Testing and Materials

ANSI
American National Standards Institute

AISI
American Iron and Steel Institute

Bus (As used in this specification)
A three-phase junction common to two or more ways

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

IEC
International Electrotechnical Commission

NEMA
National Electrical Manufacturers Association

Solid Dielectric Switch
A switchgear assembly which is mainly insulated with solid dielectric material such as plastic, rubber, ceramic, paper, composites, mica, etc. and uses no liquid or SF6 insulation to electrically insulate the various points of potential within the device

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

Tapped Way
A way solidly connected to the bus

Way
A three-phase circuit entrance to a switching assembly

4. Electrical Ratings

Nominal Voltage (Series)	25 kV
Maximum Design Voltage	27 kV
Device	Load Break Switch
BIL Phase-to-Phase, Phase-to-Ground	125 kV
BIL Across Open Contacts	125 kV
One Minute Withstand Voltage (60Hz)	60 kV
One Minute Withstand Routine Test Voltage (60Hz)	40 kV
Continuous Current	630 A
Load Switching	630 A
Mechanical Switch Operations	10,000
Peak Current	41.6 kA
Maximum Emergency 3-Time Interrupting	2000A
Momentary (1 s) & Make and Latch 600A ways (Symmetrical) 600A ways (Asymmetrical)	 16 kA 24.8 kA

Note: These ratings are applicable for altitudes not exceeding 1000 m and ambient air temperatures in the range of -30 °C to +40 °C.

5. Construction Requirements

5.1. Electrical

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

5.1.2. 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 630A continuous and 25,600A asymmetrical momentary. The mechanism shall have a minimum life of 10,000 operations at a full 630 Amp load without the need for servicing or adjustments.

5.1.3. All internal bus shall be of copper bar, copper ribbon, or copper braid. No aluminum shall be used.

5.2. Tank Construction

5.2.1. 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.

5.2.2. The tank body shall be cylindrical in shape with a nominal diameter of 30.5” and a height of 24”.

5.2.3. The top and bottom of the tank body shall have a material thickness of AISI 11 ga., and the cylindrical tank walls shall have a material thickness of AISI 14 ga.

5.2.4. Bushings shall accept cable terminations as per IEEE 386-1995. They shall be arranged to allow for easy cable training while maintaining a minimum 6” spacing between the 600A bushings.

5.2.5. The entire switch tank shall be hermetically sealed and be fully submersible with all tank bushings welded.

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

5.2.7. 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.

5.2.8. 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 C57.12.26-1993).

5.2.9. 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.

5.2.10. The unit shall be fitted with a sealed port, pressure gauge and shielding system for the visual indication of tank sealing integrity.

5.3. 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 made of hot-dip galvanized carbon steel or stainless steel.

5.4. Dielectric

5.4.1. Unit shall utilize solid dielectric material to insulate all internal components. The solid dielectric materials in combination with spacing internal to the sealed tank shall withstand the normal and abnormal service conditions as specified in IEEE 37.74 – 2003 and IEC 60529 - 2004.

5.4.2. Load interruption shall take place in sealed vacuum contacts.

5.4.3. The unit is a sealed system and requires no servicing of the dielectric.

6. Manual Operating Provisions

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

6.2. Load break 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.

6.3. Load break switch operating handles shall be capable of being padlocked in both the open and closed positions and shall be labeled to clearly indicate switch position.

7. Load Break Switch Operating Mechanism

7.1. The load break 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.

7.2. The load break switch shall be of a gang-operated three-phase design so that all contacts of the three phase mechanism shall be operated simultaneously, with no possibility of single phasing due to teasing of switch handle.

7.3. The load break 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.

8. Position Indicators

The switch handles of the load break switch shall act as position indicators that clearly and positively indicate the open and closed positions of the switch mechanism. A stainless steel nameplate shall be affixed to the switch tank adjacent to the operating handle to assist in identifying the switch position.

9. Motor Operating Provisions

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

10. Terminations

The switch bushings shall accommodate cable terminations in accordance with ANSI/IEEE 386 – 2006.

11. Bushing Designation

The switch bushings shall be identified and legibly marked adjacent to each bushing with the appropriate phase designation using a stainless steel nameplate.

12. Main Nameplate

12.1. A nameplate of stainless steel shall be provided.

12.2. The nameplate shall be securely welded to the tank.

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

12.4. The nameplate shall contain at minimum the following information:

- **12.4.1.** Name of manufacturer
- **12.4.2.** Date of manufacture (month and year, for example, 1-90)
- **12.4.3.** Serial number
- **12.4.4.** Model number or style number
- **12.4.5.** Rated maximum voltage
- **12.4.6.** Rated impulse withstand voltage
- **12.4.7.** Rated continuous current
- **12.4.8.** Rated load interrupting current
- **12.4.9.** Rated momentary current
- **12.4.10.** Rated making current
- **12.4.11.** A three-line bushing-oriented schematic diagram, using standard symbols (this may be put on a separate nameplate)

12.4.12. Total weight (including insulating medium)

12.4.13. Type of insulating medium

13. Routine Testing Requirements

13.1. 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.

13.2. Electrical

13.2.1. AC hi-pot for 1 minute phase-to-phase, phase-to-ground, and across open contacts on all ways at 40kV.

13.2.2. Mechanical switch operational test.

13.2.3. DC resistance test on all main circuits using 100 amps. The measured resistance shall not exceed 1.2*Ru, where Ru is equal to the resistance measured before the design (type) temperature-rise test.

13.2.4. Partial discharge test: 100 pC max for a complete 3 phase assembly; 20 pC max for a phase or module tested alone. Modular testing is permitted in all cases. Partial discharge tests will not be performed across open contacts of the vacuum interrupters.

13.2.5. Test reports certifying the vacuum switch conforms to ANSI C37.74 and IEC 60529.

14. Shipping Requirements

14.1. The switch shall be completely assembled.

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

15. Documentation

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