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 
ut 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 
brake 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

<table>
<thead>
<tr>
<th>Ratings for the Unit/System Voltage</th>
<th>15kV</th>
<th>25kV</th>
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<tbody>
<tr>
<td>Nominal Voltage</td>
<td>15kV</td>
<td>25kV</td>
</tr>
<tr>
<td>Maximum Design Voltage</td>
<td>15.5kV</td>
<td>27kV</td>
</tr>
<tr>
<td>BIL Phase-to-Phase, Phase-to-Ground</td>
<td>95kV</td>
<td>125kV</td>
</tr>
<tr>
<td>BIL Across Open Contacts</td>
<td>95kV</td>
<td>150kV</td>
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<tr>
<td>One Minute Withstand (60Hz)</td>
<td>34kV</td>
<td>40kV</td>
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<tr>
<td>Continuous Current</td>
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<tr>
<td>Load Switching</td>
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<td>600A</td>
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<td>Load Break Operations at Full Load</td>
<td>10,000</td>
<td>10,000</td>
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<tr>
<td>Maximum Interrupting Current</td>
<td>50kA</td>
<td>50kA</td>
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<tr>
<td>Maximum Three-Time Emergency</td>
<td>2000A</td>
<td>2000A</td>
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<tr>
<td>Make and Latch</td>
<td>600A ways (Asymmetrical)</td>
<td>20kA</td>
</tr>
<tr>
<td></td>
<td>200A ways (Asymmetrical)</td>
<td>15kA</td>
</tr>
</tbody>
</table>

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.


5.1 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.