Grid Smart. Grid Tough.

SERIES SD3100 / SD3110
SPECIFICATION

SOLID DIELECTRIC
15 KV & 25 KV SUBMERSIBLE
& VAULT MOUNTED
VACUUM LOAD INTERRUPTERS AND VACUUM FAULT INTERRUPTERS
WITH VISIBLE DISCONNECTS

MANUALLY-OPERATED / REMOTELY OPERATED
DEAD FRONT SUBMERSIBLE AND VAULT MOUNTED SOLID DIELECTRIC SWITCHGEAR WITH VACUUM LOAD-INTERRUPTING SWITCHES AND VACUUM FAULT INTERRUPTERS WITH VISIBLE DISCONNECTS

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

TABLE OF CONTENTS

TABLE OF CONTENTS…… 2
1 Scope……3
2 Definitions……..3
3 Construction Requirements……4
3.1 Electrical……..…. 4
3.2 Overcurrent Relays…….. 5
3.3 Ratings……6
3.4 Tank Construction……..……....7
3.5 Mounting Stand……..……..7
4 Dielectric…… 7
5 Manual Operating Provisions……7
6 Loadbreak Switch, Fault Interrupter
and Visible Disconnect Switch Operating Mechanism……...8
7 Position Indicators……8
8 Motor Operating Provisions…… 9
9 Terminations…… 9
10 Bushing Designation…… 9
11 Nameplate……...9
12 Testing Requirements……...9
12.1 Tank……..9
12.2 Electrical…….. 9
13 Shipping Requirements……10
14 Documentation……... 10

1. Scope

This specification applies to solid dielectric insulated 15kV & 25kV 60Hz class three-phase gang operated submersible & vault mounted, load interrupting & vacuum fault interrupting assemblies with maximum continuous ratings of 630A 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 Manufactures 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 Solid Dielectric

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

2.11 Switched Way

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

2.12 Tapped Way

A way solidly connected to the bus

2.13 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 630A continuous and 25,600A asymmetrical momentary . The mechanism shall have a minimum life of 2,000 operations 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 630A continuous, 16,000A RMS symmetrical fault interrupting, 25,600A asymmetrical momentary and shall have a minimum life of 2,000 operations at a full 630A load without the need for service, replacements, or adjustment. The fault interrupter trip mechanism shall be solenoid actuated and shall have a stored energy latching solenoid to provide trip energy. The device shall be controlled by 9 to 24 VDC.

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 630A continuous and 25,600A 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 loadbreak 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, copper ribbon, or copper braid shall be used and no aluminum shall be used. All connections shall be locked in place by a secondary componet 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. Cable connectors used shall be IP 68 submersible rated and plugged into IP 68 submersible rated connectors that are mechanically threaded into couplings which are welded onto the tank and sealed with sealant.

3.1.7 All electronic controls, relays, trip modules, and backup power supplies shall be housed in a stainless steel NEMA class 6X / IP68 enclosure attached to the outside of the switch tank. If remotely located, the control can either be stainless steel or plastic.

3.1.8 Control power for operating relays and tripping of fault interrupter shall be provided by an internally mounted 1000:1 ratio current transformers mounted on the load side bushings.

3.1.9 Optional – If non- C.T. powered relays or SCADA controls are a requirement, control power for operating relays, tripping power, and charging battery systems shall be provided by an internaly or externally mounted and fuse protected potential transformer wired to the common bus through a dedicated bushing on the switchgear.

3.2 Overcurrent Relays

The overcurrent relays shall be Thomas & Betts SSGC model 10 or 20 with the capability to:

3.2.1 Provide three-phase trip.

3.2.2 Provide monitoring of load.

3.2.3 Time current curves shall be dip switch settable.

3.2.4 Relay stores a total of 64 time current curves. Relay has 24 resident curves installed and 40 future curves available. Any plotted curve may be installed via firmware to future curves.

3.2.5 Relay has last trip indicator phase light (external power needed to light indicators via front plug).

3.2.6 Relay may be powered by either current transformers with a minumin load current of 15A of one phase, or a total of all three phases, or by an external power source

3.2.7 Relay ready light blinks when relay is operational.

3.2.8 For the SSGC0010, each phase has separate minimum trip pick-up selector switch.

3.2.9 For the SSGC0020, a single three-phase pickup will be provided along with two time delay dials and a ground fault trip dial.

Optional overcurrent relays can be an SEL 501 and 751 series relays

3.3 Ratings

Ratings for the Unit / System Voltage				
Nominal Voltage (Series)	**15kV (SD3100)**		**25kV (SD3110)**	
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**	**125kV**	**125kV**
Production One Minute Withstand (60Hz)	**34kV**	**34kV**	**40kV**	**40kV**
DC Withstand	**53 (5 min)**	**53 (15 min)**	**78 (5 min)**	**78 (15 min)**
Continuous Current	**630A**	**630A**	**630A**	**630A**
Load Switching	**630A**	**630A**	**630A**	**630A**
Mechanical Endurance (min)	**2,000**	**2,000**	**2,000**	**2,000**
Maximum Interrupting Current (Symmetrical)	**630A**	**16kA**	**630A**	**16kA**
Peak Current	**41.6KA**	**41.6KA**	**41.6KA**	**41.6KA**
Number of Fault Interruptions at approx. 16kA	**N/A**	**16**	**N/A**	**16**
Number of Fault Interruptions at approx. 10kA	**N/A**	**56**	**N/A**	**56**
Number of Fault Interruptions at approx. 3kA	**N/A**	**44**	**N/A**	**44**
Maximum Emergency 3-Time Interrupting	**2000A**	**N/A**	**2000A**	**N/A**
Momentary & Make and Latch **600A ways (Symmetrical)** **600A ways (Asymmetrical)**	 **16kA** **25.6kA**	 **16kA** **25.6kA**	 **16kA** **25.6kA**	 **16kA** **25.6kA**

Notes:

- These ratings are applicable for altitudes not exceeding 1000 m and ambient air temperatures in the range of -30 °C to +40 °C.
- Optional Load Break Switch and Fault Interrupter ratings of 20kA Symmetrical / 32kA Asymmetrical are available.
- 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. Bolted/gasketed viewing windows are acceptable.

3.4.2 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.

3.4.3 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, unless otherwise specified, in a slanted-vertical fashion 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 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″ (11.1 mm) 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 Mounting Stand

A mounting stand can 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 construction. The stand shall be designed to easily accept the future addition of a Motopak mounting rack.

4. Dielectric

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 – 2014, IEC 62271-111 2012 Sec Ed (Harmonized Standard C37.60) and IEC 62271-103, Ed. 1.0 20011-06.

4.2 Load interruption shall take place in sealed vacuum contacts.

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

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 interrupter's operating handle is moved to the open position. The trip mechanism shall function independently of the fault interrupter's 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. A tripped VFI shall be resettable by moving the operating handle to the open position.

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 made available as an optional feature.

9. Terminations

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

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 (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 / hydrogen mixture 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 DC resistance test on all main circuits using 100 amps.

12.2.3 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.

12.2.4 Production test reports available for every unit certifying the vacuum switch conforms to ANSI C37.74 and IEC 62271-111.

13. Shipping Requirements

13.1 The switch shall be completely assembled.

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.