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1.0 SCOPE

This specification describes the design, manufacturer and testing of the type SLS *Smart Sectionalizer™* (Smart Line Sectionalizer). The type SLS Sectionalizer is a three-phase electronically controlled sectionalizer suitable for pole or substation mounting. The sectionalizer uses vacuum interrupters, current transformers, and capacitive voltage sensors encapsulated in outdoor Hydrophobic Cycloaliphatic Epoxy (HCEP). The type SLS Sectionalizer is supplied standard with three internal current transformers and six internal capacitive LEA voltage sensors. The SLS Sectionalizer is compatible with the SEL-2411 Programmable Automation Controller. Other custom electronic controls are available upon request.

2.0 STANDARDS

The SLS Sectionalizer has been designed and tested in accordance with the following standards as applicable:

IEEE Std. C37.63-2013- IEEE standard for Automatic Line Sectionalizers for Alternating Current Systems up to 38kV.

IEEE C37.60™-2012/IEC62271-111 edition 2.0:2012-09 standard – IEEE/IEC standards for vacuum interruption reclosers.

IEC62271-111 edition 2.0:2012-09 edition 2.0:6.11- X-Radiation Limits test standard.

IEC62271-111 edition 2.0:2012-09 edition 2.0:6.106- Partial discharge (corona) test standard.

The SEL-2411 Programmable Automation Controller relay shall be designed and Tested to the following standards:

IEC60255-5:2000 Dielectrics and Impulse

IEC61000-4:2001 Electrostatic Discharge Immunity, RF Immunity, Fast Transient-Surge Immunity

IEC60255-22-1:2005 Surge Withstand Capability Immunity. Contact SEL for full details on applicable standards.

3.0 DESIGN REQUIREMENTS

3.01 Service Conditions

The sectionalizer shall be suitable for outdoor installation in electric power distribution and substations circuits under the following conditions:

Temperature

The sectionalizer shall perform in an ambient temperature range of -30°C through +40°C.

Altitude

The sectionalizer shall perform at elevations up to 1000 m above sea level. Contact factory for derating for altitudes above 1000 m.

Wind Loading

The sectionalizer shall be capable of withstanding wind loads up to 90 mph without loss of function.

Additional Requirements

If any site-specific service conditions not covered in sections 3.01.01 through 3.01.03 exists (e.g. extreme cold temperature installation, corrosive environment, high altitude installation, etc.) they will be defined in the quotation request.

3.02 Ratings

The SLS Sectionalizer shall be designed and tested in accordance with this specification and applicable standards. Ratings of the sectionalizer as follows:

3.02.01 Ratings

| Rating | SLS15 | SLS27 | SLS38 |
|---------------------------------------|-----------------|--------------|--------------|
| Maximum Voltage (kV) | 15.5 | 27.0 | 38.0 |
| Continuous Current (A) | 630 / 800 / 900 | | |
| Rated Frequency (Hz) | 50 / 60 | | |
| Basic Insulation Level (kV) | 110 / 150 | 150 / 170 | 170 |
| Load Break (A) | 630 / 800 / 900 | | |
| Symmetrical Interrupting Current (kV) | 12.5 / 16 | | |
| Asymmetric Peak Making Current (kA) | 42 | | |
| Magnetizing Current (A) | 22 | | |
| Line Charging Current (A) | 2 | 5 | |
| Cable Charging Current (A) | 10 | 25 | 40 |
| 60 Hertz Withstand Voltage (kV): | | | |
| <i>Dry, one minute</i> | 50 | 60 | 70 |

| | | | |
|---|------------|------------|-------------|
| <i>Wet, ten seconds</i> | 45 | 50 | 60 |
| Partial Discharge (corona) (kV): | 10 | 19 | 26 |
| <i>Maximum (pC)</i> | 1 | | |
| Creepage Distances (mm / in): | | | |
| <i>Terminal to Terminal</i> | 673 / 26.5 | 876 / 34.5 | 1160 / 45.7 |
| <i>Lower Terminal to Ground</i> | 679 / 26.7 | 938 / 36.9 | 1500 / 59.1 |
| <i>IEC Pollution Class Terminal to Ground</i> | Very Heavy | | |
| Mechanical Life (Close / Open Operations) | 10,000 | | |
| Ambient Temperature (°C) | -30 to +40 | | |

3.02.02 Duty Cycle

Duty per ANSI C37.60/ IEC62271-111 edition 2.0:2012-09

Operating duty: O- 0.5 s- CO - 1 s - CO -1 s – CO

(For Sectionalizers, see load break capacity ratings)

| Percent of Maximum Circuit Interrupting Rating | Minimum X/R Ratio | Number of Unit Operations at 12.5 kA rating | Number of Unit Operations at 16.0 kA rating |
|--|-------------------|---|---|
| T20 | 4 | 44 | 44 |
| T50 | 8 | 56 | 56 |
| T100 | 15 | 16 | 16 |
| | | Total 116 | Total 116 |

3.02.03 Weight (Base units, no accessories)

| Smart Sectionalizer™ | kg (lbs.) |
|-----------------------------|------------------|
| SLS15 | 120 (264) |
| SLS27 | 140 (308) |
| SLS38 | 200 (440) |

| Wooden Pole Mounting Hanger | kg (lbs.) |
|------------------------------------|------------------|
| SLS Pole Mounting Hanger | 33.1(73) |

4.0 Sectionalizer Construction

The SLS Sectionalizer system shall consist of a single tank Sectionalizer with the SEL-2411 Programmable Automation Control.

The sectionalizer tank shall be constructed of 304 stainless steel and painted ANSI-70 gray. The Sectionalizer tank will be equipped with lifting four lugs for four-point lifting. A center of gravity drawing shall be available.

4.01.01 The sectionalizer shall be operated using magnetic actuators for open and close operation.

4.01.02 The sectionalizer tank shall be designed to permit access for service.

The Sectionalizer shall utilize environmentally friendly Hydrophobic Cycloaliphatic Epoxy (HCEP) as the dielectric insulating medium. The vacuum interrupters, current transformers, and voltage sensors shall be directly encapsulated in the HCEP. The use of SF₆ gas or oil for insulation or interruption is prohibited. Foam or polyurethane insulation systems are not allowed.

A sensing current transformer, 1000:1 ratio, for use with the Sectionalizer control, shall be an integral part of each solid epoxy Sectionalizer module. The CT shall be molded into the epoxy module. The control will use the current reading for the sectionalizing scheme as well as SCADA points of measurement. A 4-digit mechanical counter shall be provided on the bottom panel of the sectionalizer housing.

A manual high-visibility, yellow operating handle shall be provided under the sleet hood. The sleet hood shall restrict the buildup of ice on the handle operation shaft.

Pulling the yellow handle down when in the closed position shall result in a manual opening operation. With the handle in the OPEN position, the sectionalizer is in a “lock” position and shall not accept an electrical close signal from the control.

Returning the yellow operating handle to the CLOSED position shall not close the sectionalizer. The yellow operating handle must be returned to the CLOSED position for the sectionalizer to respond to a close signal from the SEL control. All closing operations are initiated by the control.

A red/green (closed/open) indicator flag shall be visible on the bottom panel of the Sectionalizer housing to provide contact position indication of all three phases. The position indicator shall be mechanically linked to the opening mechanism providing positive indication of all three phase positions. The indicator shall be visible 360° from ground level. The closed/open indicator shall be fitted with amber LEDs which when driven by the control will illuminate when a fault target setting has been exceeded. (Fault Target Indicator)

The sectionalizer shall have an operating temperature range of -30 °C to +40 °C as defined by standards as normal service conditions for outdoor switchgear.

5.0 Mechanism

5.01 The sectionalizer mechanism shall consist of a single-coil permanent magnet magnetic actuator for each phase. No operating power is required to hold the unit open or closed.

Close and trip capacitors shall be used to store the necessary energy for operating the magnetic actuator.

The sectionalizer and its SEL-2411 control shall operate (open/close) while the overhead system is “dead” or without voltage, off the controls internal 24Vdc battery system. Dead line closing shall be possible for multiple operations without system voltage.

6.0 Solid Dielectric Insulation

Hydrophobic Cycloaliphatic Epoxy (HCEP) shall be utilized as the dielectric insulating medium and be highly resistant to ozone, oxygen, moisture, contamination and ultraviolet light. No coatings or UV protective covers are acceptable.

6.01.01 The Hydrophobic Cycloaliphatic Epoxy (HCEP) shall provide high resistance to damage.

6.01.02 The Hydrophobic Cycloaliphatic Epoxy (HCEP) shall provide complete encapsulation of the internal vacuum interrupter. The encapsulation shall also be completely bonded to the source and load side bushing terminals.

6.01.03 The creepage distance from terminal to ground of the Solid dielectric modules shall meet or exceed IEC-60815 site pollution severity class “Very Heavy.”

7.0 Vacuum Interrupters

The sectionalizer shall make use of Transverse Magnetic Field (TMF) vacuum interrupters.

8.0 Current Transformers (CT)

The current transformers shall be an integral part of the Hydrophobic Cycloaliphatic Epoxy (HCEP) module. The CTs shall be 1000:1 sensing CT's used for all current measurements for the control.

The current transformers shall be protected by a CT protection board internal to the sectionalizer mechanism tank.

9.0 Voltage Sensors

The voltage sensors shall be an integral part of the Hydrophobic Cycloaliphatic Epoxy (HCEP) bushings. The voltage sensors shall have an associated voltage ratio dependent on the rated maximum system voltage of the sectionalizer.

The voltage sensors shall be of the Low Energy Analog (LEA) type. Each three phase sectionalizer shall have six (6) LEA (Low Energy Analog) capacitive voltage sensors. Three on the load side and three on the source of each pole. The voltage sensors shall be encapsulated within each sectionalizer module permitting voltage readings on the source and load of each phase module. The LEA signals to the control shall utilize the control cable cabling or a separate voltage sensor cable if required.

10.0 Mounting Frames

The SLS Sectionalizers shall have pole hangers and substation mounting frame options.

11.0 Sectionalizer Production Testing

11.01 The Sectionalizer shall be subjected to the following production tests as outlined in **IEEE C37.63-2013 and IEEE C37.60™-2012/IEC62271-111 edition 2.0:2012-09 standards.**

11.01.01 Operational calibration tests to assure the sectionalizer and control are operational, three phase currents, and fault indication tests.

11.01.02 Electrical operations test as driven from the control.

11.01.03 One-minute power-frequency dry withstand test, 60 Hz on main circuit.

11.01.04 Contact resistance test on the main circuit.

11.01.05 Control, secondary wiring and accessory check test.

11.01.06 Partial discharge test.

11.01.07 Mechanical operations test, 25 O-C.

11.01.08 Voltage and current metering accuracy test.

12.0 Sectionalizer Type Testing

Upon request the manufacturer shall provide a type test summary according to applicable sections of **IEEE C37.63-2013 and IEEE C37.60™-2012/IEC62271-111 edition 2.0:2012-09 standards.**

13.0 DOCUMENTATION REQUIREMENTS

13.01 Approval Drawings

The manufacturer shall furnish approval drawings in AutoCAD .DWG format via e-mail. The purchase order will designate the name and e-mail address of the individual where the drawings should be forwarded. If there are no comments to the approval drawings purchaser will respond via e-mail that drawings are approved as submitted with no changes. If comments are required, one (1) copy of the drawings will be returned to the manufacturer within 10 days from the date of transmittal marked “approved with comments as noted”.

13.02 Final Drawings

The manufacturer shall furnish final drawings in AutoCAD .DWG format via e-mail. Unless otherwise specified in the purchase order, the final drawings will be forwarded to the same individual that the approval drawings were sent to.

13.03 Instruction Books

The manufacturer shall furnish an electronic copy of each applicable instruction book in Adobe Acrobat .PDF format via e-mail. Unless otherwise specified in the purchase order, the instruction book(s) will be forwarded to the same individual that the approval drawings were sent to.

13.04 Additional Documentation

One complete set of final drawings and one copy of each applicable instruction book shall be shipped in a weatherproof envelope with each sectionalizer.

14.0 SHIPPING and DELIVERY

Refer to Southern States LLC terms and conditions. All sectionalizers, associated controls, and optional items shall be palletized together.

15.0 WARRANTY

Refer to Southern States LLC terms and conditions. All Sectionalizers and their accessories furnished under this specification shall be covered by a five-year warranty from date of shipment against failure due to design or to defects in workmanship or material.

16.0 SPECIFIC QUOTE REQUIREMENTS

Information furnished by purchaser at time of quote request will include:

1. Voltage rating- 15.5/ 27/38
2. Continuous current rating- 630/800/900
3. Fault interrupting current rating (kA)- 12.5/16
4. Terminals- Stud/Eyebolt/ 2 or 4-hole flat pad
5. Animal guards if required
6. SEL control MOT configuration and accessories, if applicable
7. Control cable length
8. Type of pole frame mounting
9. Site-ready equipment requirements- Arresters, potential transformers, disconnect switches, bypass switches, etc.