



Title: Southern States – LSH & LSH-B Horizontal Interrupter Style Line Switchers	Product Specification Guide
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## 1.0 SCOPE

This specification covers the design, manufacture, and testing of three pole, gang operated horizontal interrupter outdoor line switchers available with or without integral motor operated vertical break disconnect switches.

## 2.0 STANDARDS

The outdoor line switchers shall be designed, manufactured, assembled, and tested in accordance with the latest applicable ANSI, NEMA, and ASTM standards and guidelines. If there are any conflicts between the ANSI, NEMA, or ASTM standards and this specification the specification shall govern.

## 3.0 DESIGN REQUIREMENTS

### 3.01 General

All control components required to operate the line switcher shall be mounted at a height readily accessible from ground level without the use of elevating devices.

### 3.02 Service Conditions

The line switcher shall be suitable for outdoor installation in electric power substations under the following conditions:

#### 3.02.01 Temperature

The line switcher shall perform in an ambient temperature range of -40°C through +50°C for 169 kV and below units and -30°C through +50°C for 242 kV units.

#### 3.02.02 Altitude

The line switcher shall perform at elevations up to 3,300 feet.

#### 3.02.03 Seismic

The line switcher shall be capable of withstanding seismic loading of 0.2 g ground acceleration in any direction when installed on the manufacturer's furnished support structure and anchor bolts and with flexible connections to the terminal pads. The device shall perform its specified functions during and after the seismic event.

#### 3.02.04 Wind Loading

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

#### 3.02.05 Additional Requirements

If any site specific service conditions not covered in sections 3.02.01 through 3.02.04 exist (e.g. extreme cold temperature installation,

corrosive environment, high altitude installation, etc.) they will be defined in the quotation request.

### 3.03 Ratings

#### 3.03.01 Electrical

Maximum Voltage (kV)	38	48.3	72.5	121	145	169	242
Interrupter/Blade BIL (kV)	350/200	350/250	350/350	550/550	750/650	750/750	900/900
Continuous Current	1200 A, 1600 A, or 2000 A for all kV ratings						
Load Current Interrupting	1200 A, 1600 A, or 2000 A for all kV ratings						
Loop Current Interrupting	1200 A, 1600 A, or 2000 A for all kV ratings						
Line Charging Current Interrupting	400 A for all kV ratings						
Rated Short Time (3 sec) Withstand	40 kA RMS for all kV ratings						
Fault Closing	10 time 40 kA, 15 time 31.5 kA, 30 time 20 kA for all kV ratings						
Number of Mechanical Operations	2000 for all kV ratings						

#### 3.03.02 Additional

1. Rated Interrupting Time                      1 second

#### 3.03.03 Source Supply Voltages

Purchaser will supply the following sources for the motor, auxiliary, and control circuits:

1. Motor Voltage                                      48 VDC or 125 VDC
2. Auxiliary Voltage                                120 / 240 VAC, 60 Hz, 1Ø
3. Control Voltage                                 48 VDC or 125 VDC

### 3.04 Interrupter

The line switcher shall use SF<sub>6</sub> single gap puffer interrupters. Each interrupter shall be provided with a color-coded pressure gauge, an overpressure relief device, and a gas fill port. Arc assist type interrupters are not acceptable. Hermetically sealed interrupters are not acceptable due to the inherent dangers to purchaser's personnel associated with handling fully pressurized SF<sub>6</sub> devices during installation and also due to potential hazards encountered during transportation and offloading.

### 3.05 Insulators

The line switchers shall be supplied with manufacturer furnished insulators in accordance with the following table. The insulators shall be ANSI 70 gray in color and porcelain in construction.

Voltage Class	TR Number of the Required Insulator
38.0 kV	TR 231
48.3 kV	TR 267
72.5 kV	TR 276 on the non-rotating stacks
	TR 278 on the rotating stacks
121 kV	TR 286
145 kV	TR 288
169 kV	TR 291
242 kV	TR 304

### 3.06 Terminal Pads

Terminal pads shall be unplated aluminum with 4 hole NEMA drilling pattern for use with purchaser furnished terminal connectors. The terminal pads on both ends of the line switcher shall be at the same elevation above the line switcher base.

### 3.07 Operating Mechanisms

#### 3.07.01 Motor Operating Mechanism

A rotational output motor operating mechanism shall be provided to trip the interrupters and to close the interrupters, to reset the opening and closing springs, and to open and close the vertical break disconnect switch blades on models furnished with disconnect switch blades. Reciprocating output operating mechanisms are not acceptable. The motor operating mechanism shall operate from full open to full closed in 8 seconds, from full closed to full open in 8 seconds, and shall generate 32,000 inch-pounds of output torque. The operating mechanism shall be capable of being padlocked in both the open and the closed positions. The ability to recouple in an incorrect position shall be positively prevented. The motor operator shall be Southern States type CM-4AE or approved equal and shall provide the following accessories in an all-aluminum enclosure:

1. Electric motor
2. Open-Close push buttons
3. Reversing contactor
4. Anti-pump relay
5. Local-remote selector switch
6. 12 stage adjustable auxiliary switch (eight stages (contacts) of which shall be available for purchaser use)

7. Thermostatically controlled 100 watt cabinet heater
8. Fused pullouts for protection of motor/control circuit and heater circuit
9. Decoupler for vertical pipe
10. Manual crank handle (Insertion of handle shall automatically disconnect the motor circuit)
11. Position indicating lights (green=open, red=closed)
12. Operations counter
13. 120 VAC cabinet light with toggle switch
14. Front and right side hinged, removable doors

#### 3.07.02 Hinge Assemblies

(Supplied on vertical break disconnect switch model line switchers)

The hinge assembly on each phase shall consist of a sealed threaded current transfer path and a counterbalance spring to allow the disconnect blades to be under full positive control during opening and closing operations.

#### 3.07.03 Switch Blades

(Supplied on vertical break disconnect switch model line switchers)

The switch blades shall be tubular aluminum with a removable tin plated copper contact plate having 15 mils brazed silver inserts. The blade contact plate and the contact fingers shall be supplied with silvers of differing hardness so that galling does not occur. The switch blades shall have a rotating motion upon opening to release contact pressure and upon closing to engage contact pressure, to wipe the stationary jaw contacts clean of any contaminants, and to break any accumulated ice build-up. The interrupter shall open before the disconnect switch blade opens and shall close after the disconnect switch blade closes, thus making and breaking the circuit in an SF<sub>6</sub> environment. Line switchers that make the circuit on the switch blades are not acceptable.

#### 3.07.04 Stationary Jaw Contacts

(Supplied on vertical break disconnect switch model line switchers)

All stationary jaw contacts shall consist of formed copper contact fingers of the reverse loop type so that during short circuit conditions the reverse loop design produces high levels of opposing magnetic force in the fingers, providing increased contact pressure to hold the disconnect blades in the closed position. The current transfer surfaces on the contact fingers shall consist of 15 mils brazed silver inserts. All contact fingers shall be field replaceable. The contact fingers shall be backed by stainless steel springs that are outside of the current path.

3.08 Ground Pads

Two NEMA 2 hole ground pads shall be supplied for grounding the structure to the station ground grid.

4.0 MANUFACTURING REQUIREMENTS

4.01 Wiring

Wiring shall be:

1. Point-to-point without splices or tee connections.
2. Bundled using cable ties.
3. Clearly identified with permanently affixed markers.
4. Sized per NFPA-70 except being No. 14 AWG.

4.02 Bearings

The rotating insulator stack bearings and the outboard bearing shall be maintenance-free, double row, sealed automotive ball type.

4.03 Bases

The line switcher bases shall be constructed of rectangular steel tube to provide rigid stability and shall be hot dipped galvanized after fabrication. Double channel bases or girder style bases are not acceptable. The rectangular steel tubes shall be enclosed on the ends to birdproof the bases against nesting. Open style bases are not acceptable. The rectangular steel tubes shall be provided with welded mounting clips for rigid attachment of the bases to the support structure.

4.04 Interphase Bracing

Hot dipped galvanized steel channels shall be provided as interphase bracing and shall be sized by the manufacturer based upon the operational loads of the line switcher.

4.05 Operating Linkage

The vertical operating pipe, interphase pipe, and drive pipe shall be galvanized steel and shall be sized as required by the manufacturer to provide reliable operation of the line switcher and to prevent deflection and pipe sag.

4.06 Support Structure

Each line switcher shall be provided with a manufacturer supplied support structure consisting of one vertical column (mounting pedestal) for 38 kV through 72.5 kV units furnished with 5 foot or narrower phase spacing. Two vertical columns (mounting pedestals) shall be supplied for all 72.5 kV units furnished with greater than 5 foot phase spacing, all 121 kV and 145 kV blade model units, and all 121 kV through 242 kV non-blade model units. The 169 kV and 242 kV blade model line switchers shall be supplied with three vertical columns (mounting pedestals). All ratings of both model types shall be supplied with a unitizing support frame except the 169 kV and 242 kV blade model units, which

shall be furnished with structural support braces in a “Y” configuration. The mounting pedestals shall be hot dipped galvanized tubular steel. The frame members and/or structural support braces shall be hot dipped galvanized steel. Unless otherwise specified in the quotation request anchor bolts will be provided by the purchaser. All anchor bolts shall be sized as required for the operational loads generated by the line switcher. The manufacturer shall determine anchor bolt sizing and anchor bolt plan details when providing the anchor bolts.

## 5.0 DESIGN TESTS

The line switcher shall be design tested in accordance with ANSI C37.09-2001. The testing shall include a dielectric test, a power test, a continuous current test, and a mechanical endurance test. The dielectric test shall include 60 Hz power frequency, lightning impulse withstand, and visual corona. The power test shall include load interrupting, loop interrupting, line charging interrupting, fault closing, and short time withstand.

## 6.0 PRODUCTION TESTS

Each line switcher shall be fully assembled as a three-phase unit at the factory, adjusted, tested, and timed per ANSI C37.09 section 5.

The tests shall include:

### 6.01 Mechanical Operation

There shall be at least 50 mechanical operations performed at the factory. Timing tests along with opening and closing operations at minimum and maximum operating voltage shall be recorded.

### 6.02 Leak Test

An SF<sub>6</sub> leak test shall be performed to confirm the leak rate is less than 0.5% per year.

### 6.03 Resistance Tests

#### 6.03.01 Current Path Resistance Test

A terminal-to-terminal micro-ohm resistance check shall be performed on each interrupter using a 100 A DC source and the values shall be recorded.

#### 6.03.02 Heater Resistance Test

The resistance of each heater shall be confirmed to be within specifications and the values shall be recorded.

#### 6.04 Dielectric Tests

##### 6.04.01 Control Circuit Dielectric Test

The completely assembled and wired operator control circuit shall pass a dielectric test of 1500 V for 1 minute.

##### 6.04.02 Interrupter Dielectric Test

Each interrupter shall pass a power frequency withstand test at 60 Hz for one minute. The required test value shall be at least three times rated line to ground voltage.

#### 7.0 SPARE PARTS

No spare parts shall be required to be purchased at the time of line switcher purchase. Stock shall be maintained at the manufacturer available for rush shipment in the event of an emergency need.

#### 8.0 DOCUMENTATION REQUIREMENTS

##### 8.01 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 then one copy of the drawings will be returned to the manufacturer within 10 days from the date of transmittal marked “approved with comments as noted”.

##### 8.02 Final Drawings

The manufacturer shall furnish 3 copies of final drawings and a CD of these final drawings in AutoCAD .DWG format. The purchase order will provide the “attention to” person and the physical address for forwarding the final drawings and CD.

##### 8.03 Instruction Books

The manufacturer shall furnish 3 copies of each applicable instruction book. These instruction books shall be transmitted to the same individual that the final drawings are to be sent to unless purchaser otherwise instructs manufacturer at time of purchase order placement.

##### 8.04 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 line switcher.



## 9.0 SHIPPING and DELIVERY

The line switcher shall be match-marked and disassembled as necessary to accommodate shipping dimensional clearance restrictions or shipped assembled on its common subframe. The line switcher phases shall be shipped fully assembled on insulators, minimizing the amount of field installation time required. Each interrupter shall be shipped with a positive pressure of 5 – 10 psi of SF<sub>6</sub>, eliminating the need to pull a vacuum on the interrupters in the field. An SF<sub>6</sub> fill kit shall be provided to fill each interrupter to rated pressure during installation.

## 10.0 WARRANTY

All line switchers 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.

## 11.0 SPECIFIC QUOTE REQUIREMENTS

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

1. Model type (blade or non-blade)
2. kV rating
3. Continuous current rating
4. Motor / Control voltage (48 VDC or 125 VDC)
5. Heater voltage (120 VAC or 240 VAC)
6. Mounting pedestal height
7. Phase spacing
8. If manufacturer is to supply anchor bolts
9. Additional requirements, if applicable (see section 3.02.05)

## 12.0 ACCEPTABLE LINE SWITCHER

Supply Southern States type LSH (non-blade model) or LSH-B (blade model) or acceptable equal. Any equal proposed must meet or exceed this specification.