Southern States

Title: Southern States – CSH(2) & CSH(2)-B Horizontal Interrupter Style Circuit Switchers	Product Specification Guide

TABLE OF CONTENTS

1.0 SCOPE

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

2.0 STANDARDS

The outdoor circuit 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 circuit switcher shall be mounted at a height readily accessible from ground level without the use of elevating devices.

3.02 Service Conditions

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

3.02.01 Temperature

The CSH and CSH-B circuit switcher shall perform in ambient temperature ranges per the ratings in section 3.03.01. For ambient temperatures outside of these ranges, please consult factory.

3.02.02 Altitude

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

3.02.03 Seismic

The circuit 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 circuit 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

CSH & CSH-B 38 kV – 170 kV

BLADE BIL RATINGS (For CSH-B)

Max Voltage:	Blade BIL
38 kV	200 kV
48.3 kV	250 kV
72.5 kV	300 kV
123 kV	550 kV
145 kV	650 kV
170 kV	750 kV

550 kV BIL Interrupter Ratings [1]

	Temp Range	≤ 72.5 kV	123 kV
PBF 100s	-30°C to +50°C		20 kA
	-40°C to +50°C	25 kA	
	-50°C to +40°C	15 kA [3]	12 kA [3]
TLF	-40°C to +50°C	4 kA	2.9 kA [2]
	-50°C to +40°C	2.5 kA [3]	1.7 kA [3]

750 kV BIL Interrupter Ratings [1]

	Temp Range	≤ 72.5 kV	123 kV	145 kV [2]	170 kV [4]
PBF 100s	-40°C to +50°C	25 kA	20 kA		
	-50°C to +40°C	15 kA [3]	12 kA [3]		
TLF	-40°C to +50°C	4 kA	2.9 kA [2]	2.3 kA [2]	2.7 kA [2]
	-50°C to +40°C	2.5 kA [3]	1.7 kA [3]	1.4 kA [3]	1.6 kA [3]

Notes (550 kV & 750 kV BIL):

1) Ratings shown are for 1200A (*for 1600A, top temperature is +40^{O}C*).
Ratings **do not** apply to 2000A.
Ratings apply to both porcelain and composite interrupter housings.

2) Nameplate will include note "**TLF = 4 kA @ 7.6 kV/µs TRV**."

3) SF_6 / N_2 Gas Mixture

4) 170 kV ratings are for Grounded Systems (1.3 kpp) - All other ratings are suitable for Ungrounded Systems (1.5 kpp).

5) For existing installations, the 123 kV can also be rated 25 kA for -30OC to + 50OC. If 25 kA is specified for a new installation, the CSH2 design should be utilized.

CSH & CSH-B 245 kV

900 kV BIL Interrupter Ratings [1]

	Temp Range	245 kV
PBF 100s	-30°C to +50°C	20 kA
	-50°C to +40°C	12.5 kA [4]
TLF	-30°C to +50°C	4 kA
	-50°C to +40°C	2 kA [4]

1) Ratings shown are for 1200A (*for 1600A, top temperature is +40OC*).
Ratings **do not** apply to 2000A.
Ratings apply to both porcelain and composite interrupter housings.

2) SF_6 / N_2 Gas Mixture

3) The 245 kV rating is suitable for Grounded Systems.

CSH2 & CSH2-B 38 kV - 145 kV

650 kV BIL Interrupter Ratings [1]

	Temp Range	≤ 72.5 kV	123 kV	145 kV [2]
PBF 100s	-30°C to +50°C	40 kA		
	-40°C to +50°C	31.5 kA		
TLF	-40°C to +50°C	4 kA		

1) Ratings shown are for 1200A. For 1600A, top temperature is +40 ^{O}C

2) The 145 kV rating is for Grounded Systems (1.3 k_{pp}).

3) The CSH2 is currently not offered at temperatures below -40^{O}C.

4) Ratings apply to Composite Interrupter Housings.

3.03.02 Additional

1. Rated Interrupting Time — 5 cycles for 170 kV and below; 6 cycles for 245 kV
2. Rated Duty Cycle — O-15 sec-CO-15 sec-CO

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, 1∅
3. Control Voltage — 48 VDC or 125 VDC

3.04 Interrupter

The circuit switcher shall use SF_6 single gap puffer interrupters. Each interrupter shall be provided with a color-coded density gauge, an overpressure relief device, and a gas fill port. Arc assist type interrupters are not acceptable. Hermetically sealed interrupters are available on request. A Hermetically sealed interrupter requires a composite interrupter housing and must be shipped fully pressurized as it is not refillable by the user.

Hermetically Sealed Definition – A Hermetically sealed device is designed so that no person, other than the manufacturer, can add gas to the device.

3.05 Insulators

Circuit switchers cannot be supplied less insulators. Insulators should be supplied per manufacture's recommendations and shall be ANSI 70 gray standard station post insulators.

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 circuit switcher shall be at the same elevation above the circuit switcher base.

3.07 Operating Mechanisms

3.07.01 Shunt Trip Mechanisms

Each circuit switcher shall be provided with a spring stored energy shunt trip mechanism per phase located under the rotating insulator stack to provide high speed tripping. A single stored energy mechanism located at ground level is not acceptable.

3.07.02 Motor Operating Mechanism

A rotational output motor operating mechanism shall be provided 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 close in less than 15 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. Time delay relay
6. Local-remote selector switch
7. 12 stage adjustable auxiliary switch (eight stages [contacts] of which shall be available for purchaser use)
8. Thermostatically controlled 100 watt cabinet heater
9. Fused pullouts for protection of motor circuit and heater circuit
10. Decoupler for vertical pipe
11. Manual crank handle (Insertion of handle shall automatically disconnect the motor circuit)
12. Position indicating lights (green=open, red=closed)
13. Operations counter
14. 120 VAC cabinet light with toggle switch
15. Front and right side hinged, removable doors

3.07.03 Hinge Assemblies
(Supplied on vertical break disconnect switch model circuit 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.

3.07.04 Switch Blades
(Supplied on vertical break disconnect switch model circuit 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_6 environment. Circuit switchers that make the circuit on the switch blades are not acceptable.

3.07.05 Stationary Jaw Contacts
(Supplied on vertical break disconnect switch model circuit switchers)

All stationary jaw contacts shall consist of formed copper contact fingers of the reverse loop type so that during short circuit conditions that exceed the interrupting rating of the circuit switcher 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 circuit 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 circuit 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 circuit switcher and to prevent deflection and pipe sag.

4.06 Support Structure

Each circuit 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 123 kV and 145 kV blade model units, and all 123 kV through 245 kV non-blade model units. The 170 kV and 245 kV blade model circuit 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 170 kV and 245 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 circuit switcher. The manufacturer shall determine anchor bolt sizing and anchor bolt plan details when providing the anchor bolts.

5.0 DESIGN TESTS

The circuit switcher shall be design tested in accordance with ANSI C37.016-2006. 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, lighting impulse withstand, and visual corona. The power test shall include short circuit interrupting, fault closing, and short time withstand.

6.0 PRODUCTION TESTS

Each circuit 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_6 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 circuit 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 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.

8.03 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.

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 circuit switcher.

9.0 SHIPPING and DELIVERY

The circuit switcher shall be match-marked and disassembled as necessary to accommodate shipping dimensional clearance restrictions or shipped assembled on its common subframe. The circuit 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_6, eliminating the need to pull a vacuum on the interrupters in the field. An SF_6 fill kit shall be provided to fill each interrupter to rated pressure during installation.

10.0 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. Maximum System Fault Available
5. Motor / Control voltage (48 VDC or 125 VDC)
6. Heater voltage (120 VAC or 240 VAC)
7. Mounting pedestal height
8. Phase spacing
9. If manufacturer is to supply anchor bolts
10. Additional requirements, if applicable (see section 3.02.05)

11.0 ACCEPTABLE CIRCUIT SWITCHER

Supply Southern States type CSH(2) (non-blade model) or CSH(2)-B (blade model) or acceptable equal. Any equal proposed must meet or exceed this specification.