Title: Southern States – CSV-CB/DB Vertical Interrupter Style Circuit Switcher w/ Disconnect	Product Specification Guide

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1. SCOPE

   This specification covers the design, manufacture, and testing of three pole, gang operated vertical interrupter outdoor circuit switchers with an integral disconnect switch (center break or doble end break design).

2. STANDARDS

   All outdoor circuit switchers and disconnects 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. Service Conditions

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

   3.1. Temperature

   The circuit switcher shall perform in an ambient temperature range of -40°C through +50°C.

   3.2. Altitude

   The circuit switcher shall perform at elevations up to 3,300 feet (1000m).

   3.3. Seismic

   The circuit switcher and disconnect 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 circuit switcher shall perform its specified functions during and after the seismic event.

   3.4. Wind Loading

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

   3.5. Additional Requirements

   If any site specific service conditions not covered in sections 3.01.01 through 3.01.05 exists (e.g. extreme cold temperature installation, corrosive environment, high altitude installation, etc.) they will be defined in the quotation request.

4. Circuit Switcher Design

4.1. Electrical

RATINGS				
Maximum Voltage Rating (kV)	**72.5**	**123**	**145**	**170**
Interrupter/Blade Minimum BIL (kV)	350	550	650	750
Continuous Current	2000 A, 3000 A, 4000 A*			
Power Frequency	60 Hz			
Short-Time Withstand	50 kA (3 sec)			
Peak Withstand	130 kA			
Insulator Design	Porcelain			
Ambient Temperature Range	-40^{O}C to +50^{O}C standard *(-50^{O}C to +50^{O}C optional)*			
CIRCUIT SWITCHER RATINGS:				
Primary Fault Interrupting	25 kA, 31.5 kA, 40 kA			
Secondary Thru-Fault Interrupting	4 kA			
Interrupting Time	3 cycles			
Short-Circuit Making	50 kA			

* Consult factory for 4000 A ratings

4.2. Rated Duty Cycle

Rated Duty Cycle: O-0.3 sec-CO-15 sec-CO

4.3. Source Supply Voltage

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

Motor Voltage: 48 VDC, 125 VDC, 250 VDC, 120 VAC, or 240 VAC
Auxiliary Voltage 120 / 240 VAC, 60 Hz, 1∅
Control Voltage 48 VDC, 125 VDC, 250 VDC, 120 VAC, or 240 VAC

4.4. Interrupter

The circuit switcher shall use SF_6 single gap interrupters. Each interrupter shall be provided with an overpressure relief device and shall be field refillable. Hermetically sealed interrupters are not acceptable due to the inherent dangers to purchaser's personnel associated with handling fully pressurized SF_6 devices during installation and also due to potential hazards encountered during transportation and offloading.

4.5. Insulators

The support insulators and the interrupter insulators shall be ANSI 70 gray in color and either porcelain or composite in construction.

4.6. SF_6 Gas System

The circuit switcher shall have a gas system constructed of rigid copper piping or a combination of rigid copper piping and flexible stainless steel tubing that allows each interrupter to be pressurized through a fill port.

The gas system shall include the insulator and a color coded, temperature compensated density gauge that is visible from the ground and which is furnished with low-pressure alarm and lockout contacts. The density gauge must be at ground potential. Battery powered gas density monitors are not acceptable.

The system shall be constructed such that the density gauge can be isolated from the interrupter to allow the low-pressure alarm and lockout contact set points to be verified. A means for refilling the system in the field without disassembling the circuit switcher must be provided. The device shall have a leak rate of less than 0.5% per year.

4.7. Terminal Pads

Terminal pads shall be unplated aluminum with 4 hole NEMA drilling pattern for use with purchaser furnished terminal connectors. The terminal pads shall be reversible for mounting at the top, bottom, or either side of the interrupter.

4.8. Circuit Switcher Operating Mechanism

4.8.1. Spring Operating Mechanism

Each circuit switcher shall be provided with a spring open-spring close mechanism capable of a duty cycle of O-0.3 seconds-CO-15 seconds-CO. The spring shall be charged via an electric motor in 15 seconds or less. Pneumatic, hydraulic, or combination pneumatic/hydraulic mechanisms are not acceptable. Devices utilizing multiple mechanisms are not acceptable.

4.8.2. Mechanism Housing and Control Components

An ANSI 70 gray painted steel mechanism housing shall be furnished and shall be provided with the following accessories:

- Electric spring charging motor
- Color coded, temperature compensated gas density gauge with low-pressure alarm contact and low-pressure lockout contact
- Trip-close pistol grip switch
- Close coil
- Dual trip coils
- Anti-pump relay
- Local-remote selector switch
- A minimum of 10 spare non-adjustable auxiliary switch contacts factory set as 5 normally open (NO) and 5 normally closed (NC) contacts
- Thermostatically controlled cabinet heater
- Molded case circuit breakers for protection of motor circuit, control circuit, and heater circuit
- Spring charged-discharged indicator
- Manual closing spring charging handle
- Open-Close position indicator
- Position indicating lights (green=open, red=closed)
- Manual trip lever
- Operations counter
- 120 VAC cabinet light with door actuated switch
- View window in cabinet door
- 120 VAC duplex receptacle with GFCI
- Hinged cabinet door with 3 point latch, open position door stop, and padlocking provisions

4.8.3. Ground Pads

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

4.9. MANUFACTURING REQUIREMENTS

Wiring

Wiring shall be:

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

Base Frame

Each circuit switcher shall be provided with a manufacturer furnished base frame which houses the gas piping for the three support/interrupter insulators which form the gas system while also housing the interpole linkage that connects the three interrupters to the spring operating mechanism. Phase spacing shall be as shown in the following table:

Maximum kV Rating	Phase Spacing Options (inches)
48 and 145	84, 96, or 102
170	84, 96, 102, or 120

4.10. DESIGN TESTS

The circuit 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, lighting impulse withstand, and visual corona. The power test shall include short circuit interrupting, fault closing, and short time withstand.

4.11. 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:

Mechanical Operation

There shall be at least 50 mechanical operations performed at the factory. Timing tests, opening and closing operations at minimum and maximum operating voltage, and spring recharge time shall be recorded.

Leak Test

An SF_6 leak test shall be performed to confirm the leak rate is less than 0.5% per year.

Resistance Tests

4.11.1.1. 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.

4.11.1.2. Heater, Coil, and Relay Resistance Test

The resistance of each heater, coil, and relay shall be confirmed to be within specifications and the value(s) shall be recorded.

Dielectric Tests

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

4.11.1.4. 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.

5. SWITCH DESIGN

5.1 Electrical

Center Break Disconnects* (Types EC-1 and EC-2) &

Double End Break Disconnects (Type RDA-1)

Maximum Voltage	48.3 kV	72.5 kV	123 kV	145 kV	170 kV	245 kV
BIL	200 kV	350 kV	550 kV	650 kV	750 kV	900 kV
Continuous Current	2000 A, 3000 A, 4000A					
Rated Short Time RMS Symmetrical	63 kA (3 sec), 164 kA peak					
Ambient Temperature Range	-40°C to +50C -50°C Optional					
Number of Mechanical Operations	1000 for all kV ratings					

* Ratings vary slightly for center break disconnects depending on style selected (EC-1 or EC-2)

5.2 Operating Mechanism

The operating mechanism will be as specified on the request for quotation and will be either a swing handle operator, a worm gear operator, or a motor operator. The maximum operating force to open or close the switch when using a swing handle operator shall be 50 lbs force exerted at the end of a 3 foot effective length handle. The maximum operating force to open or close the switch when using a worm gear operator shall be 35 lbs force exerted at the end of the crank handle. The operating mechanism shall be capable of being padlocked in both the open and the closed position. To prevent the disconnect from being opened or closed when the circuit switcher is closed, interlocking, either electrical, mechanical, or both should be provided.

5.3 Production Tests

Each disconnect switch shall be assembled as a single phase unit at the factory, with insulators (as specified), adjusted, and final test completed.

The minimal tests shall include:

5.3.1 Mechanical Operation

Open and Close checks shall be performed.

5.3.2 Resistance Tests

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.

5.3.3 Motor Operator Electrical Interlock Test

If there is an electrical interlock between the Circuit Switcher and a Disconnect Motor Operator the operation sequence should be shown on the drawings and tested in the factory prior to shipment.

6. SUPPORT STRUCTURE

Each circuit switcher with integral disconnect shall be provided with a manufacturer supplied support structure consisting a minimum of two vertical support columns. The structure shall be capable of supporting both the circuit switcher and disconnect along with associated control and operator enclosures. The mounting pedestal shall be hot dipped galvanized steel, shall be manufacturer's standard height offering for the specific kV rating unit requested, and shall allow convenient ground level access to the control components. 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.

7. 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. DOCUMENTATION REQUIREMENTS

8.1. 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”.

8.2. 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.

8.3. 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.

8.4. 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. SHIPPING and DELIVERY

The circuit switcher shall be match-marked and disassembled as necessary to accommodate shipping dimensional clearance restrictions. 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 the interrupters to rated pressure during installation.

10. SPECIFIC QUOTE REQUIREMENTS

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

- kV rating
- Continuous current rating

- Fault interrupting rating
- Motor / Control voltage (48 VDC, 125 VDC, 250 VDC, 120 VAC, or 240 VAC)
- Heater voltage (120 VAC or 240 VAC)
- Phase spacing
- Switch Type
- Switch Operator type
- If manufacturer is to supply anchor bolts