



Title: Southern States 15.5 kV-38 kV <i>CapSwitcher</i> <sup>®</sup> Vertical Interrupter Style Capacitor Switcher	Product Specification Guide
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## 1.0 SCOPE

This specification covers the design, manufacture, and testing of three pole, gang operated vertical interrupter outdoor capacitor switchers with integrated transient over-voltage control and inrush current mitigation.

## 2.0 STANDARDS

All outdoor capacitor 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 Service Conditions

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

#### 3.01.01 Temperature

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

#### 3.01.02 Altitude

The capacitor switcher shall perform at elevations up to 4,000 feet.

#### 3.01.03 Seismic

The capacitor switcher shall be capable of meeting IEEE 693's high seismic performance level. The device shall perform its specified functions during and after the seismic event.

#### 3.01.04 Wind Loading

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

#### 3.01.05 Additional Requirements

If any site-specific service conditions not covered in sections 3.01.01 through 3.01.04 exist (e.g. extreme cold temperature installation, corrosive environment, high altitude installation, etc.) they will be defined in the quotation request.

### 3.02 Ratings

#### 3.02.01 General Specifications

Rated Maximum Voltage	15.5 kV	27 kV	38 kV
Rated Power Frequency Withstand Voltage	50 kV	60 kV	80 kV
Rated Lightning Impulse Withstand Voltage (BIL)	110 kV	150 kV	200 kV
Rated Power Frequency	50/60 Hz		
Rated Continuous Current	600 A		
Peak Fault-Making (Asymmetrical) {10 Cycles}	65 kA peak		
Symmetrical Fault-Making {10 Cycles}	25 kA RMS		
Peak Withstand Current	65 kA peak		
Short-Time Symmetrical Withstand	25 kA RMS 1 sec		
Rated High-Frequency Transient-Making Current / Transient Inrush Frequency	42 kA peak / 8100 Hz		
Rated Short Circuit Interrupting Current	N/A		
Rated Duty Cycle	15 sec – C – 6 cycles – O (Capacitor bank must be discharged to below 10% before closing is allowed.)		
<b>CAPACITOR SWITCHING RATINGS (IEEE C37.09a-2005)</b>			
Rated Capacitive Switching Current	600 A		
Back-to-Back Capacitor Bank Breaking Current	600 A		
Rated High-Frequency Transient-Making Current / Transient Inrush Frequency	23 kA peak / 5400 Hz		
Resistor Value	See Table in 3.03.01 Pre-insertion time 5-12 ms		



3.05 SF<sub>6</sub> Gas System

Each phase of the capacitor switcher shall have a color-coded, temperature-compensated pressure gauge. The fill pressure shall be 52 psig nominal and 32 psig minimum. The capacitor switcher shall have a leak rate of less than 0.5% per year.

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 shall be reversible for mounting at the top, bottom, or either side of the interrupter.

3.07 Operating Mechanism

3.07.01 Spring Operating Mechanism

The capacitor switcher shall be provided with a spring open-spring close mechanism with a mechanism duty cycle of 15 sec – C – 6 cycles - O. When issued a close command, the springs shall be charged via an electric motor in 15 seconds or less. The closing spring shall then actuate the mechanism to the closed position leaving the opening spring charged to allow a 6 cycle opening once an open command energizes the trip coil and releases the opening spring. Pneumatic, hydraulic, or combination pneumatic/hydraulic mechanisms are not acceptable. Devices utilizing multiple mechanisms are not acceptable.

3.07.02 Mechanism Components

1. Electric spring charging motor
2. Trip coil
3. 6 spare non-adjustable auxiliary switch contacts factory set as 3 normally open (NO) and 3 normally closed (NC) contacts
4. Open-Close position indicator
5. Manual trip capability
6. Mechanical operations counter
7. Thermostatically controlled heater

3.08 Ground Connections

Two grounding connections which accept #8 solid to #2/0 stranded connectors shall be supplied for grounding the mechanism to the station ground grid.

4.0 MANUFACTURING REQUIREMENTS

4.01 Mechanism Housing

Each capacitor switcher shall be provided with a housing that connects the three interrupters to the spring operating mechanism at 24 inch phase spacing for 15.5 kV, 27 kV, and 38 kV.

4.02 Support Structure

The capacitor switcher is designed to be mounted on a capacitor bank platform or structure provided by customer. Mounting details of the capacitor bank platform or structure must be defined in the quotation request.

5.0 DESIGN TESTS

The capacitor switcher shall be design tested in accordance with IEEE C37.66-2005, Standard Requirements for Capacitor Switches for AC systems (1 kV to 38 kV), unless otherwise noted in section 3.02.01. 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 fault closing, short time withstand, resistor fault closing, and shunt capacitor bank switching. The capacitor switcher shall also be design tested in accordance with IEEE C37.09a in demonstration of the ability of the capacitor switcher to switch capacitive current multiple times as in a back-to-back capacitor bank switching application.

6.0 PRODUCTION TESTS

Each capacitor switcher shall be fully assembled as a three-phase unit at the factory, adjusted, tested, and timed. The tests shall include:

6.01 Mechanical Operation Tests

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.

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 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.

6.03.02 Heater, Coil, and Relay Resistance Tests

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

6.03.03 Closing Resistor Value Tests

The value of the resistor in each interrupter shall be confirmed to be within specifications and 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 capacitor 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 Drawings

The manufacturer shall furnish drawings of the capacitor switcher in AutoCAD .DWG format or Adobe Acrobat .PDF format via e-mail. The purchase order will designate the name and e-mail address of the individual to whom the drawings should be forwarded.

##### 8.02 Instruction Books

The manufacturer shall furnish an electronic copy of the instruction book, 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.

##### 8.03 Additional Documentation

One complete set of drawings and one copy of the instruction book shall be shipped in a weatherproof envelope with each capacitor switcher.

#### 9.0 SHIPPING AND DELIVERY

All capacitor switchers shall be shipped completely assembled and fully pressurized, ready for quick and easy field installation.

#### 10.0 WARRANTY

All capacitor switchers and their accessories furnished under this specification shall be covered by a five-year warranty from date of shipment or 10,000 operations; whichever comes first; 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. Rated Maximum Voltage
2. Closing resistor value
3. Motor / Control voltage (48 VDC, 125 VDC, or 120 VAC, 60 Hz, 1Ø)
4. Additional requirements, if applicable (see section 3.01.05 and section 4.02)

12.0 ACCEPTABLE CAPACITOR SWITCHER

Supply Southern States type *CapSwitcher*<sup>®</sup> or acceptable equal. Any equal proposed must meet or exceed this specification.

*CapSwitcher*<sup>®</sup> is a registered trademark of Southern States, LLC.