



The Quality Name in High Voltage Switching

**Type CAP**

***CapSwitcher*<sup>®</sup>**

**Capacitor Switching Device**

**15.5 kV – 38 kV**

**INSTALLATION &**

**INSTRUCTION**

**MANUAL**



# Safety Information



## **DANGER**

THE EQUIPMENT COVERED IN THIS MANUAL SHOULD BE HANDLED, INSTALLED, AND MAINTAINED BY TRAINED PERSONNEL ONLY. IMPROPER HANDLING, INSTALLATION, OPERATION OR MAINTENANCE OF THIS EQUIPMENT MAY CAUSE IMMEDIATE HAZARDS WHICH WILL LIKELY RESULT IN SERIOUS PERSONNEL INJURY OR DEATH.

## **WARNING**

The equipment covered by this publication must be handled, installed, operated and maintained by qualified persons who understand any hazards involved and are thoroughly trained in the handling, installation, operation and maintenance of high voltage transmission and distribution equipment. These instructions are meant for only such qualified persons. They are not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

A qualified person is one who is trained in and has skills necessary:

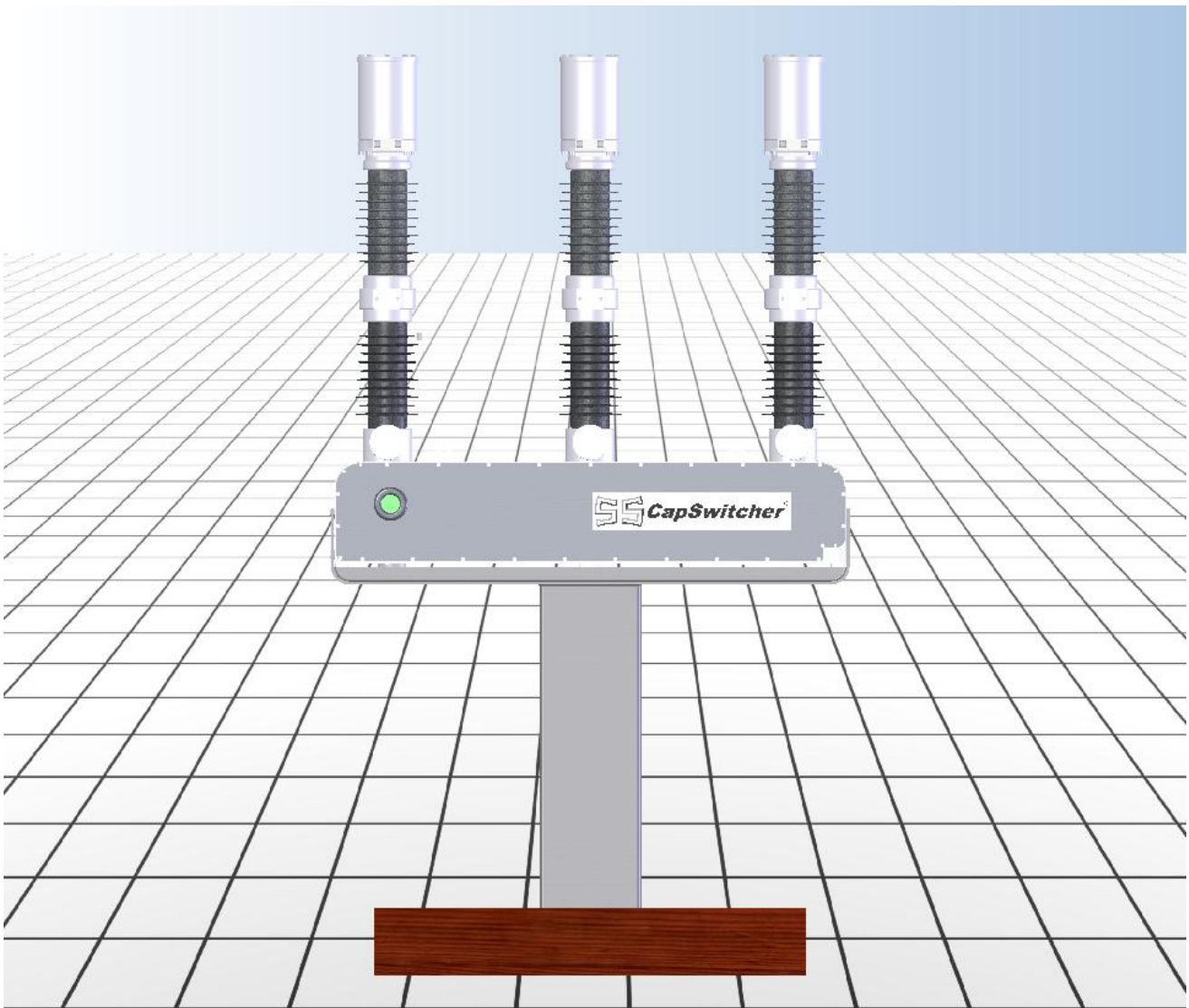
- to distinguish between energized and non energized parts
- to determine proper approach distances to energized parts
- to determine proper approach to energized or de-energized equipment that may be pressurized with gas
- proper use of personal protective equipment, insulating and shielding materials, insulated tools for working near energized and /or pressurized electrical equipment
- Knowledge of special purpose equipment that may be unbalanced, pressurized or may have other special attributes that require precautions in handling, installation, operation and maintenance

The instructions in this manual are general guidelines for this type of equipment and not specific to the equipment supplied. Portions of it may not be applicable or may not have complete instructions for your specific equipment. If you do not understand any part of these instructions or need assistance, contact Southern States Service Division at 770-946-4562.



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### Important

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Southern States reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material, or both, the latter shall take precedence.

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### Summary

These instructions do not intend to cover all details or variations in equipment, or provide for every possible contingency to be met in connection with installation, operation or maintenance. Should information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Southern States Representative.

The contents of this instruction manual should not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Southern States. The Warranty contained in the contract between the parties is the sole warranty of Southern States. Any statements contained herein do not create new warranties or modify the existing warranty.

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## Introduction

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## Introduction

The Southern States Type CAP **CapSwitcher**<sup>®</sup> is an outdoor three-phase interrupter device that provides excellent capacitor switching capabilities. The interrupter is an SF<sub>6</sub> thermal puffer type. During tripping the gas within the puffer is compressed by the piston and blown at the arc to extinguish it. The mechanism is a low maintenance spring/spring motor charged mechanism. The key feature of this design is that it is available with a closing resistor.

A standard package consists of:

- 3 phase SF<sub>6</sub> gas **CapSwitcher**<sup>®</sup>
- Side mounting brackets
- Aluminum terminal Pads
- 2 Grounding mounts

The instructions contained within this manual are necessary for the safe installation, maintenance, and operation of the **CapSwitcher**<sup>®</sup>. A qualified person, familiar with this of type equipment, should carefully read and follow the instructions.

These instructions are intended to provide a general guideline for the installation, adjustment, and maintenance of the **CapSwitcher**<sup>®</sup>. It is not possible to cover all details, equipment variations, and potential conditions. Contact Southern States, LLC in the event conditions associated with a specific application are not sufficiently addressed.

Distinctive signal words are used to indicate the degree of hazard that may be encountered by the user. Identification of the signal words and their definition follow:

**▲ DANGER**

Indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

**▲ WARNING**

Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

**▲ CAUTION**

Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.



# Ratings

## Ratings

**Table 1: Ratings Table**

Ratings:	<b>CapSwitcher®</b>		
Maximum Voltage	15.5 kV	27 kV	38.0 kV
Lightning Impulse Withstand Voltage (BIL)	110	150	200
Frequency	50/60 Hz		
Continuous Current	600 A		
Shunt Capacitor Bank Switching Current	600 A		
Back-To-Back Capacitor Bank Breaking Current:	600 A		
Peak Capacitive Inrush Current:	42 kA @ 8100 Hz		
Short-Time Withstand Current and Short-Circuit Making Current	40 kA		
Duty Cycle (see text below)	10 sec - CO		
Operating pressure @20°C	52 psig nom, 32 psig min		
Operations	10,000		

Normal service conditions:

- The maximum ambient air temperature range is +122°F (+50°C) to -58°F (-50°C).
- The maximum altitude is (3280 ft) 1000 m.
- The maximum wind velocity should not exceed 90 mph (40 m/s).
- The seismic performance is Low Performance Level as defined in IEEE 693.

Higher service conditions are available and will be stated in other documents associated with the specific switcher purchase.

The **CapSwitcher®** is applied as a circuit switcher for capacitor switching application. It is designed and rated to close into a discharged bank. It is generally accepted practice that there should be a 5 minute delay between opening a capacitor bank and closing back to allow it to discharge. The standard duty cycle is 10 sec - CO with the following details:

- A 5 min delay should be observed to allow the capacitor bank to discharge before closing.
- This rating is based on closing into no more than **two** faults per hour.
- For capacitor switching operations not involving faults one operation every 5 minutes (12 per hour) is permitted.
- For no load operations, during installation and testing, the frequency of user operation can be increased, but shall not exceed 20 operations in 10 min or 30 operations in 1 hr.

Please note that the **CapSwitcher®** is a definite purpose device. It is designed and rated for capacitor switching only. It was not designed or tested for line protection, transformer protection or reactor switching.

## Receiving and Storage

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### Receiving

**⚠ WARNING** Interrupter housings contain pressurized SF<sub>6</sub> gas. Do not strike, shock, strain or in any way damage the equipment. Such damage may cause the interrupter to rupture. Improper handling may result in death, serious injury, or equipment damage.

**⚠ WARNING** The horizontal frame with interrupters center of gravity is above the lifting eyes. Follow instructions in this book for lifting. Use caution when handling to avoid personal injury or equipment damage.

**⚠ DANGER** SF<sub>6</sub> gas is heavier than air. Do not get caught in a low area with SF<sub>6</sub> gas present. The SF<sub>6</sub> can displace the oxygen. Death by suffocation is possible.

Unpack equipment and check for damage and parts shortage. Unit Assembly and Operating Mechanism drawing bill-of-material should be used for this purpose. If damage or shortage is noted, file a claim with the carrier immediately and notify the factory.

### Storage

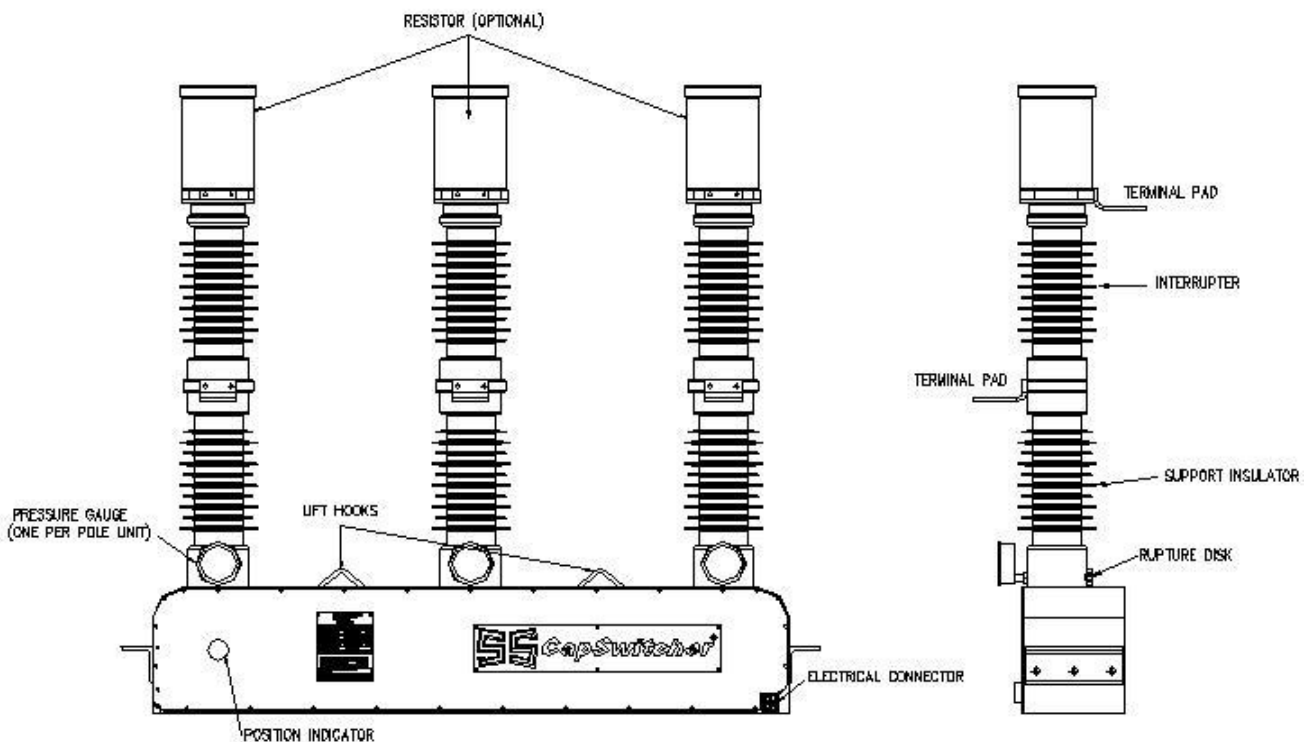
All components of the **CapSwitcher**<sup>®</sup> are suitable for outdoor use. The storage requirements are listed below:

- Inspect all packing material thoroughly prior to handling after storage.
- Protect unit from being immersed in water.
- Connect the cabinet heaters to appropriate supply to protect the mechanism and control circuit components from corrosion. (Failure to do so can void the warranty.)
- The gas system is sealed at the factory and filled with a positive pressure of dry SF<sub>6</sub> gas. Ensure that the interrupters remain sealed and filled with 52 psig dry SF<sub>6</sub> gas at all times. Do not allow moisture or dust to enter the gas system. The internal resistors will absorb moisture if exposed to the atmosphere for more than one hour. Contact factory if the resistors have been exposed for more than one hour.
- The mechanism is shipped and should be stored with the close and open springs discharged. This requirement is for the safety of personnel in handling the **CapSwitcher**<sup>®</sup> while in storage and subsequent installation.

## Description

## Description

The **CapSwitcher<sup>®</sup>** is a three-phase device with a common spring mechanism and three single break SF<sub>6</sub> interrupters designed specifically to switch capacitor banks. When transient suppression is required each interrupter is available with an internal closing resistor to suppress switching transients on the electrical system.



**Figure 1: CapSwitcher<sup>®</sup> - (Typical Construction)**

Note: Please refer to customer drawings for specific construction details.

## Interrupter

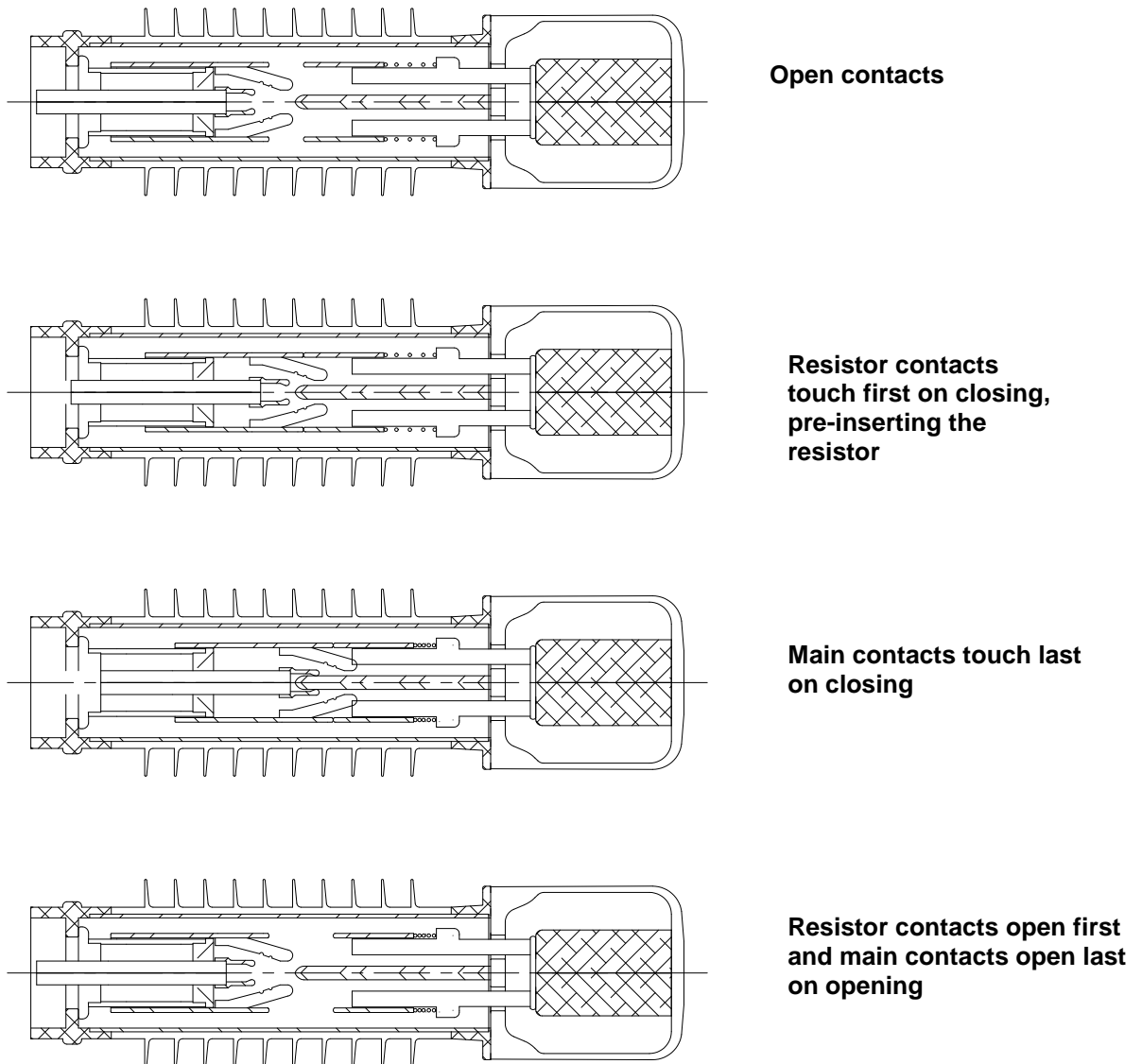
The interrupter is an SF<sub>6</sub> puffer design. It has been designed specifically for capacitor switching duty. The contact structure is robust and designed for many low current switching operations.

The closing resistor is made of a stack of carbon block resistors. Spring force holds the resistor disks together. There are no user serviceable parts in this assembly. If there is a problem in this assembly contact the factory.

## Description

The **CapSwitcher**<sup>®</sup> utilizes composite insulators. These insulators require very little maintenance. They are naturally hydrophobic and generally do not need to be washed.

A brief pictorial description of the interrupter operation is shown in Figure 2.



**Figure 2: Interrupter Operating Sequence**

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## Description

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## Operating Mechanism

**▲ CAUTION**

There are also several distinct sounds during operation which can be mistaken as the unit closing. Always check the position indicator to see if the unit has finished closing.

The operating mechanism is a traditional circuit breaker type spring/spring mechanism. It is shipped with both springs discharged. A motor is used to charge both springs by a cam mechanism. The charge motor is turned off when the interrupter closes and the cam is in a safe position. Energizing the open solenoid discharges the opening spring. Discharging the open spring opens the contacts and readies the mechanism for another cycle.

Immediately upon completion of the closing operation the mechanism is ready to open the interrupters.

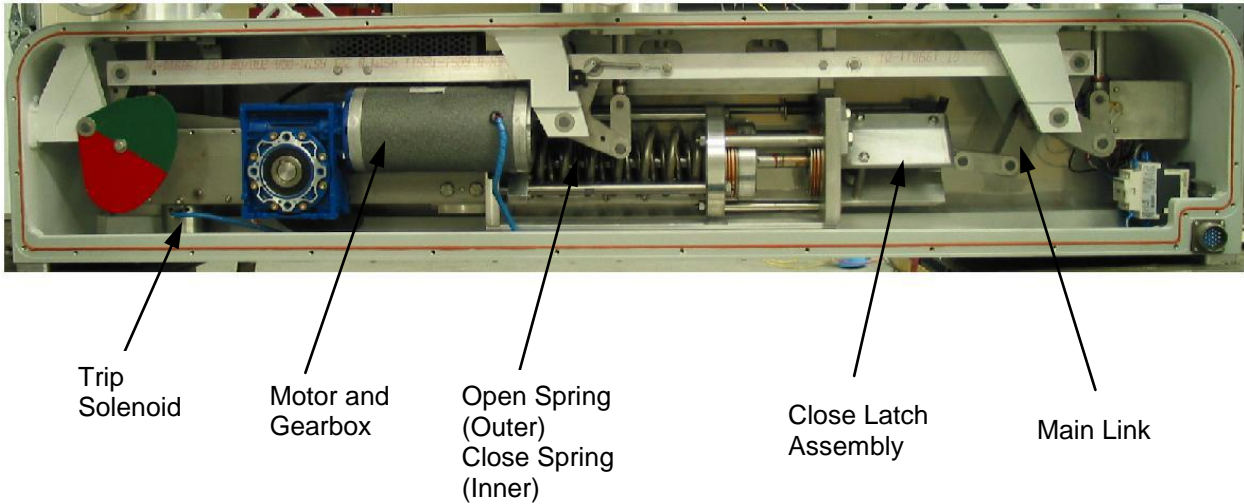
There are no user serviceable parts in the mechanism. Side covers can be removed for viewing the operation counter and for visual inspection of the mechanism. For manual operation there is a manual release button for interrupter opening. There is no manual charging port. If the **CapSwitcher<sup>®</sup>** will not charge the springs and close, contact the factory for service.

## Mechanism Operation

The open and close springs for the mechanism are charged by a single motor. Sending the close signal to the unit will start the motor, which turns a cam. The cam operates against a charging tube, which compresses both springs at the same time. The closing latch, which is at the end of the mechanism attached to the linkage, holds the closing spring until the mechanism is finished charging. The opening latch, which is located at the opposite end of the mechanism from the closing latch, only closes once the unit is finished charging.

Once the unit is completely charged, the close arm trigger will operate the close latch via a long rod. This allows only the closing spring to discharge, closing the mechanism. The opening spring remains charged until the opening solenoid is fired, moving the open latch out of the way and allowing the open spring to discharge and open the unit.

## Description



**Figure 3: Operating Mechanism**

### Manual Operation

This **CapSwitcher**<sup>®</sup> has no manual charging mechanism. If the **CapSwitcher**<sup>®</sup> will not charge and close, contact the factory for service.

This **CapSwitcher**<sup>®</sup> does have a manual open button located on the underside of the mechanism. Pressing this button while the opening spring is charged will discharge the spring and open the contacts. The button may require a significant amount of force to operate, so the button is designed to withstand blows from hooksticks and hammers. There is a mechanical block to prevent operation of the manual open while the cam is in an unsafe position.



**Figure 4: Manual Release Button**

## Description

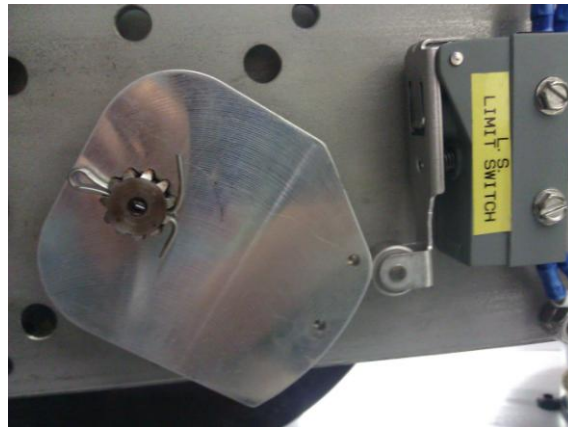
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### Solenoid Close Option

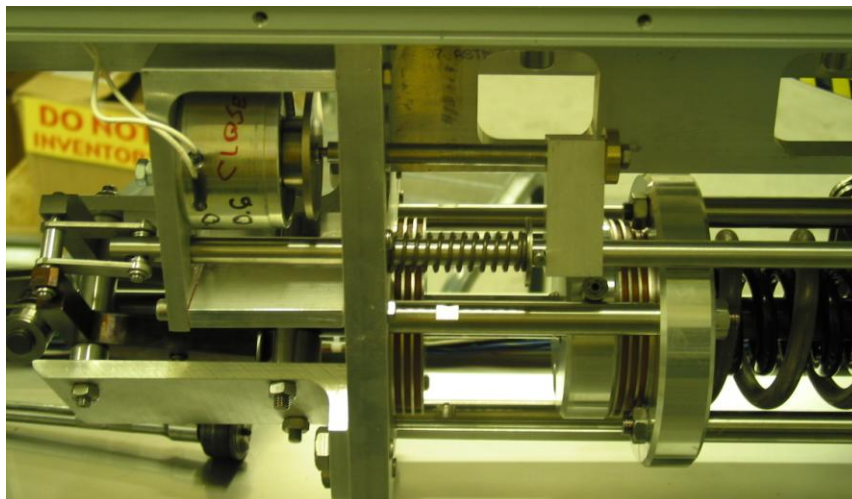
The solenoid close option on the 38kv **CapSwitcher**<sup>®</sup> uses a solenoid rather than the motor to close the **CapSwitcher**<sup>®</sup>. This option allows the **CapSwitcher**<sup>®</sup> to be closed quickly and reliably whenever the user desires.

### Description

The solenoid close option uses a solenoid mounted to the spring mechanism to pull on the closing rod. A limit switch is mounted on the charging mechanism to stop the motor in a safe position. These are the two mechanical changes made to the **CapSwitcher**<sup>®</sup>. The remainder of the parts and their functions remain unchanged. The images below illustrate these changes.



**Figure 5: Limit Switch and Trip Arm**



**Figure 6: Close Solenoid with Close Arm**

## Description

### Slow Close Prevention Mechanism

The 38kV **CapSwitcher**<sup>®</sup> includes a slow close prevention mechanism. This prevents the **CapSwitcher**<sup>®</sup> from partially or slowly closing. If there is an issue, a latch will prevent the mechanism from closing far enough to start an arc within the interrupter.

The slow close prevention mechanism uses a sacrificial tab to actuate the slow close prevention latch. This mounts to the top of the charging plate in the spring mechanism and activates a pushrod that rotates the slow close prevention latch once the charging springs are fully charged. In the event of a close latch failure, the tab will deform, the latch will stay in place, and the interrupter linkage will not be able to close. Once the tab is deformed, the **CapSwitcher**<sup>®</sup> will no longer operate and must be removed from service. If a deformed tab is encountered, please contact Southern States. Only a qualified Southern States service rep is qualified to repair a **CapSwitcher**<sup>®</sup> with a deformed tab.

Slow Close Prevention Tab

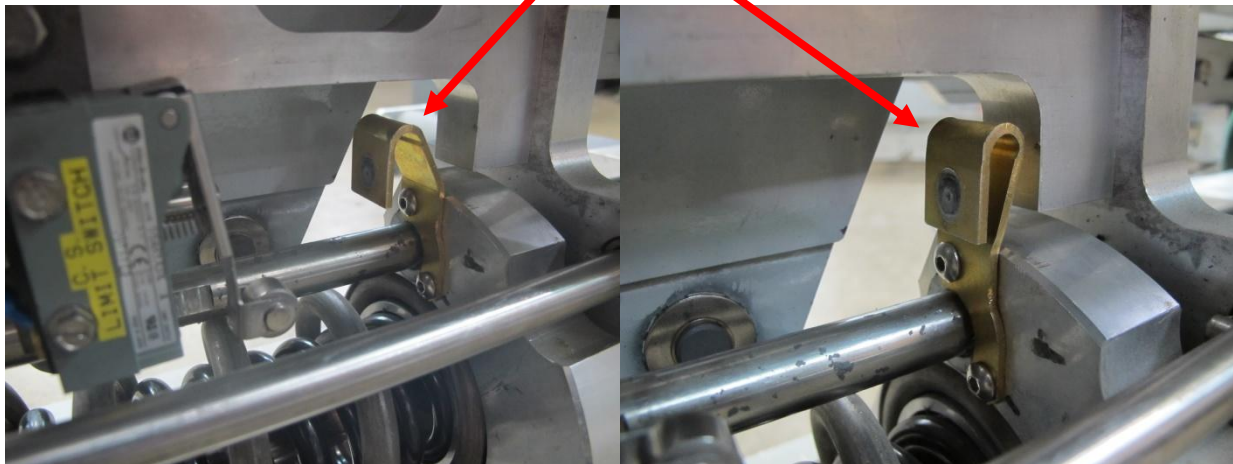


Figure 7: Tab in Normal Operation (Left), Deformed Tab (Right)

**⚠ DANGER** Attempts to bend the tab back to operate the CapSwitcher will not fix the mechanism, and could cause the interrupters to short to ground and vent gas. Bending the tab back to the non-bent state will void the warranty.



## Description

## Control System

Note: The following is a description of the basic control circuit provided by Southern States. Due to variations in customer specifications there may be differences in any given circuit. Please see schematics provided with the product to fully and accurately understand the control system on any given **CapSwitcher**<sup>®</sup>.

The **CapSwitcher**<sup>®</sup> comes with a cable with which to connect the unit to a junction box. This junction box can be supplied by Southern States if one is not available. The connector end of the cable plugs into the **CapSwitcher**<sup>®</sup> while the other end of the cable is loose, allowing the wires to be landed on the terminal block at the junction box. The typical setup is shown in Figure 7. The cable pin out is shown in Table 2.

When the **CapSwitcher**<sup>®</sup> is shipped both springs are discharged and the **CapSwitcher**<sup>®</sup> is in the open position, and relays are shown in the state shown in Figure 8.

When signal voltage is applied from the remote close, the motor control relay (MCR) closes, supplying voltage to the motor. The circuit also applies voltage to the MCR, keeping it closed until the motor is finished charging and the **CapSwitcher**<sup>®</sup> closes. When the mechanism closes, contact 52b opens, turning off the MCR and charging motor.

When the **CapSwitcher**<sup>®</sup> is in the closed position contact 52a closes, allowing the trip coil to receive a control signal. The trip coil will not operate unless the **CapSwitcher**<sup>®</sup> is in the closed position.

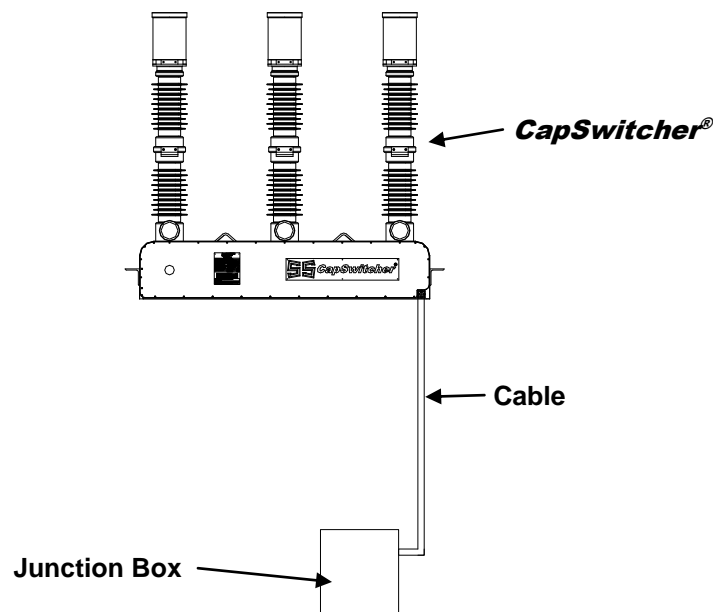


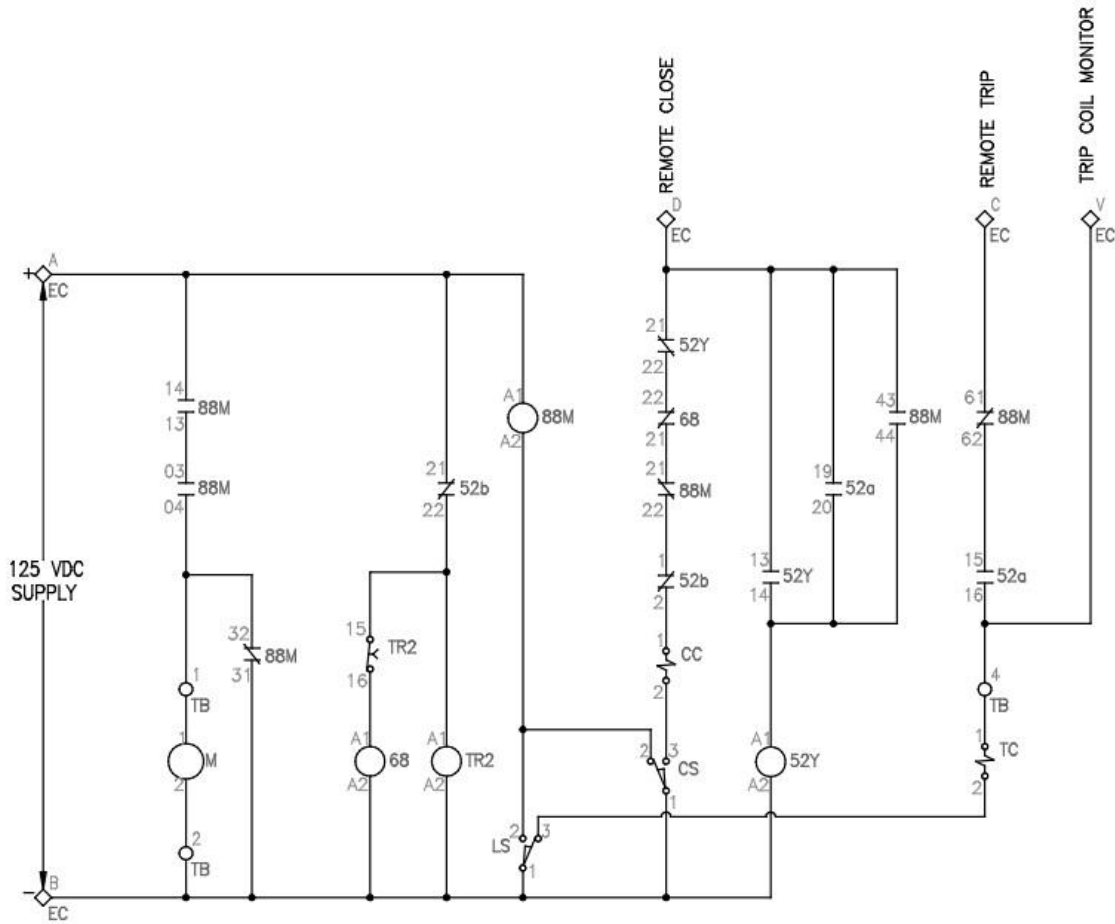
Figure 8: Typical Unit Control Setup

## Description

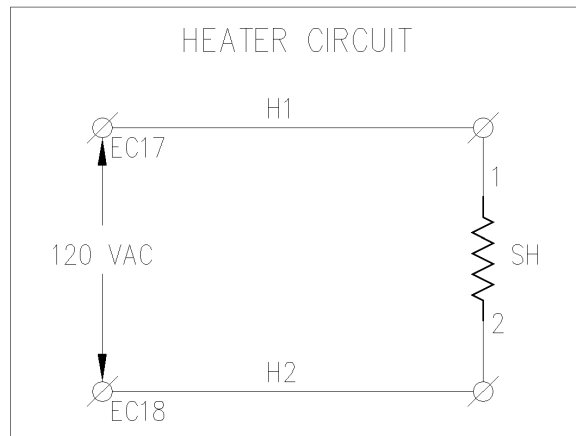
CUSTOMER PINOUT CONNECTIONS			
PIN NO.	WIRE #	WIRE COLOR	TERMINATION
EC1	J1	BLACK	POSITIVE
EC2	J2	WHITE	NEGATIVE
EC3	K5	RED	TRIP
EC4	K6	GREEN	CLOSE
EC5	B1	ORANGE	52b-1
EC6	B2	BLUE	52b-2
EC7	B3	WHT-BLK	52b-3
EC8	B4	RED-BLK	52b-4
EC9	B5	GRN-BLK	52b-5
EC10	B6	ORN-BLK	52b-6
EC11	A1	BLU-BLK	52a-13
EC12	A2	BLK-WHT	52a-14
EC13	A3	RED-WHT	52a-15
EC14	A4	GRN-WHT	52a-16
EC15	A5	BLU-WHT	52a-17
EC16	A6	BLK-RED	52a-18
EC17	H1	WHT-RED	LINE - HEATER VOLTAGE
EC18	H2	ORN-RED	NEUTRAL - HEATER VOLTAGE
EC19	K1	BLU-RED	TRIP COIL MONITOR

**Table 2: Cable Pin Out**

## Description



**Figure 9: Control Circuit (Typical)**



**Figure 10: Heater Circuit**

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## Installation & Adjustment

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### SF<sub>6</sub> Gas Handling Procedures

#### Description of SF<sub>6</sub> Gas

SF<sub>6</sub>, sulfur hexafluoride, is a colorless, odorless and chemically very stable gas. The SF<sub>6</sub> provides the dielectric insulation across the interrupter gap and it provides the means to interrupt current.

The performance of SF<sub>6</sub> gas is based on the density of the gas not the pressure. As the temperature drops so will the pressure, but the interrupter will continue to function normally.

#### Environmental and Handling Warnings

SF<sub>6</sub> has been determined to be a greenhouse gas but not an ozone depleting gas. All users should minimize emissions to the atmosphere.

#### Arc Decomposition By-Products

During current interruption the SF<sub>6</sub> gas in the arc is exposed to very high temperatures. Under these conditions SF<sub>6</sub> breaks down into its various by-products and combines with metals in the interrupter to create various gaseous and solid by-products.

The solid by-products deposit on the inside of the interrupter as a white powder. This white powder will not cause any problems with the internals of the interrupter as long as the unit is dry, sealed, pressurized, and contains adsorbent.

#### Corrosive Effects of SF<sub>6</sub> By-Products

SF<sub>6</sub> in its pure dry form is chemically very stable and causes no corrosion. When the by-products come into contact with moisture, corrosive compounds can form. The **CapSwitcher<sup>®</sup>** has adsorbent in the gas volume to keep the gas dry; therefore, these corrosive effects are not an issue for units as delivered to the field.

Opening the interrupters exposes the by-products to moisture. It is necessary to remove the by-products. The by-products can be neutralized with an alkaline solution of lime (Ca(OH)<sub>2</sub>), Sodium Carbonate (Na<sub>2</sub>CO<sub>3</sub>) or Sodium Bicarbonate (Na HCO<sub>3</sub>).

If a unit requires service then follow on page 14, Procedures for SF<sub>6</sub> Gas Handling.

<p><b>▲ DANGER</b> SF<sub>6</sub> is heavier than air. Do not get caught in a low area with SF<sub>6</sub> gas present. The SF<sub>6</sub> gas can displace the oxygen. Death by suffocation is possible.</p>
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## Installation & Adjustment

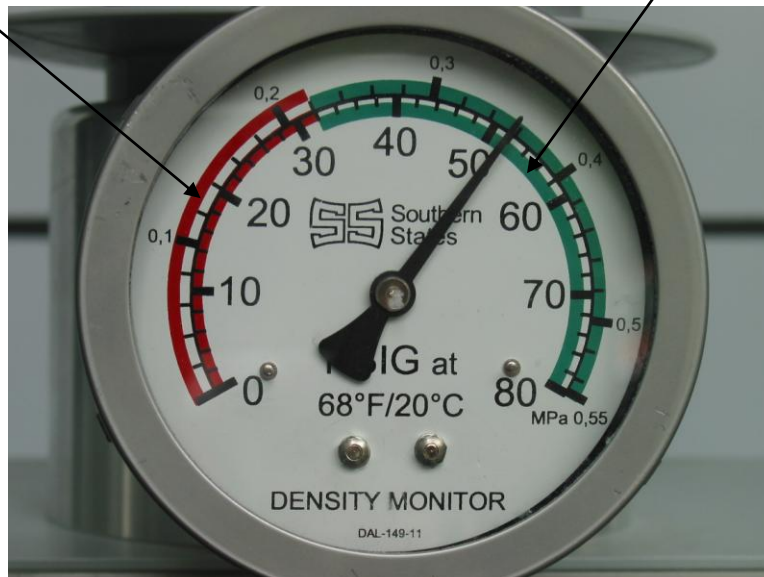
### How to read the SF<sub>6</sub> Density Gauge

The standard gauge on the **CapSwitcher**<sup>®</sup> is a temperature compensated pressure gauge. The temperature compensated pressure gauge displays a constant pressure reading over the ambient temperature range of the switcher.

- The **GREEN** zone signifies that there is adequate pressure for the **CapSwitcher**<sup>®</sup> to function properly.
- The **RED** zone indicates that there is not sufficient gas in the unit for proper performance. The unit should be taken out of service, inspected for leaks, and refilled with SF<sub>6</sub> gas; see Procedures for SF<sub>6</sub> Gas Handling in the next section.

**RED**  
(0 – 32 psi)

**GREEN**  
(32 – 80 psi)



**NORMAL OPERATING PRESSURES:**

Fill Pressure: 52 psig

Minimum Pressure: 32 psig

**Figure 11: Gauge Face**

## Installation & Adjustment

### Procedures for SF<sub>6</sub> Gas Handling

NOTE: The **CapSwitcher**<sup>®</sup> is shipped with 52 psig of dry SF<sub>6</sub> Gas. If the **CapSwitcher**<sup>®</sup> arrives with the proper pressure of SF<sub>6</sub> gas, do not remove gas or vacuum evacuate.

#### Removal of SF<sub>6</sub> Gas

If it is necessary in the life of the product to remove the gas please use a gas removal system specially designed for SF<sub>6</sub> collection. Companies like Dilo, Enervac, Cryoquip and others make these gas carts. These carts will remove the gas, filter it through various media and compress it for storage in various containers.

The **CapSwitcher**<sup>®</sup> is typically provided with a Dilo type series quick disconnect. Please contact Southern States, LLC for the necessary connector.

#### Replacing the SF<sub>6</sub> Gas: Evacuate and Fill

**This only applies if the gas system has been opened to the atmosphere.** For the SF<sub>6</sub> to have maximum electrical properties it needs to be pure. To accomplish this the gas system must be evacuated before filling with SF<sub>6</sub>.

- Evacuate
  - Remove the density monitor from the interrupter.

NOTE: **Use two wrenches, one on the density monitor to loosen it and one on the fill port to hold it tight.**

- Evacuate the gas system through the coupling using a vacuum pump.
- Pull vacuum down to below 1 torr and hold for 15 min. Be careful not to turn off the pump before closing the valve between the vessel and the vacuum pump. If the valve is not closed first the vacuum in the gas system can pull the oil out of the vacuum pump into the **CapSwitcher**<sup>®</sup>
- Before filling please be sure that the fill hose is filled with SF<sub>6</sub> gas. This is accomplished by bleeding a little gas from the bottle through the hose before opening the valve to the gas system.

#### Filling Unit With Gas

- Fill pressure: 52 psig @+20°C(+68°F).
- Quantity of gas required is 0.63 lb per interrupter or 1.9 lbs per three-phase unit.
- Use only high quality SF<sub>6</sub> per Specification:

Assay WT.%	99.9% Min
<b>Limits of Impurities</b>	
Dew Point*	-32°C (-25°F) {300 PPM}
Air as Nitrogen, WT. %	0.1 Maximum

#### Leak Detection Methods

If a leak is suspected there are various ways of discovering it.

- Pressure gauge dropping over time. This is the easiest method of detecting a leak. The only drawback is that it takes time and does not locate the leak.

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## Installation & Adjustment

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- Bubble Test using a liquid soap. This is a very good method for locating the position of a leak.
- Halogen detectors. Common halogen detectors as used for Freon will detect SF<sub>6</sub> leaks.
- SF<sub>6</sub> detectors can detect leaks down to below one part per million.

## Installation & Adjustment

The **CapSwitcher**<sup>®</sup> is shipped from the Southern States factory fully adjusted and ready for installation.

The **CapSwitcher**<sup>®</sup> is shipped with the intent to minimize gas handling during installation. During assembly, **do not open** the gas valves or discharge all of the gas to the atmosphere. The interrupters are attached to the horizontal frame at the factory and shipped with 52 psig of SF<sub>6</sub> gas.

**▲ DANGER** Be careful when lifting the **CapSwitcher**<sup>®</sup>. Tie the lifting straps as shown to keep the assembly from falling over, see Figure 11.

**▲ DANGER** Never lift the assembly by the insulators.

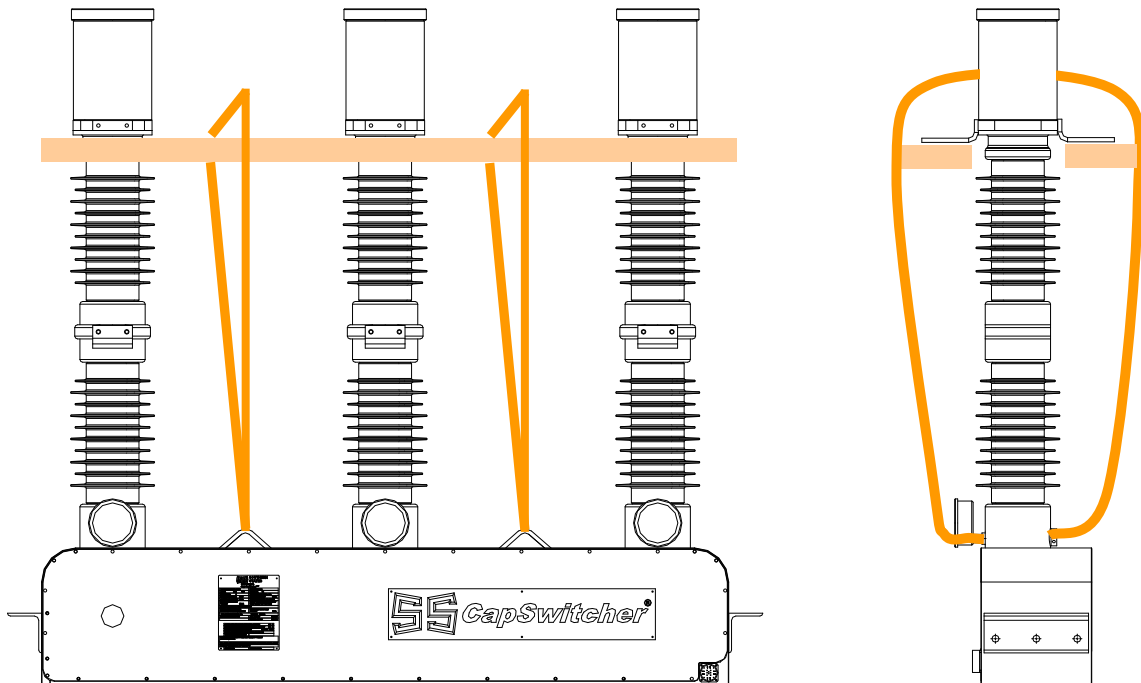
**Mechanism, Interrupters and Horizontal Frame Assembly:** Typically the **CapSwitcher**<sup>®</sup> is provided with the interrupters assembled to the horizontal frame and the horizontal frame assembled to the mechanism. If this is the case, lift the entire assembly by the four lifting eyes on the horizontal frame as shown in Figure 11.

After the **CapSwitcher**<sup>®</sup> is installed on the foundation and all of the mounting bolts are secure, remove the shipping 2X4's from the terminal pads. **Do not throw away the terminal pads** because they are to be used later in the installation.

## Installation & Adjustment

**⚠ DANGER**

Ensure that the lifting straps go around the shipping braces (2x4's) to keep the Horizontal Frame with Interrupters from flipping over during installation. The center of gravity of the unit is well above the lifting lugs.



**Figure 12: Typical Installation Diagram**



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## Installation & Adjustment

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**▲ CAUTION** Do not adjust any of the linkage lengths. This adjustment is to be done by factory authorized personnel only.

### Installation Check:

- Connect the **substation grounds** to the provided grounding lugs on the mechanism box.
- The **terminal pads** can be installed on either side of the insulator. To install the terminal pads apply NO-OX-ID A to the terminal pads and brush through the grease with a stainless steel brush. Install the terminal pads in the desired position with the supplied fasteners.

**▲ DANGER** Be sure that there is only one terminal pad on the same level on each interrupter. The interrupter is between the top and middle flange. Failure to do this will short circuit the interrupter.

- Ensure that all knife switches or fuses or circuit breakers are in the OPEN position before connecting control wiring.
- Connect control wiring.
  - Check wiring
  - Check polarity of the AC and DC supply lines
- Ensure that the local - remote switch is in the local position.

## Installation & Adjustment

### Post-Installation Testing

Once installation is complete per preceding instructions installation testing should be conducted. Please see the next section for the Installation Check-List.

**⚠ DANGER** The **CapSwitcher<sup>®</sup>** must be de-energized, isolated and grounded when performing this inspection. This test will cause the **CapSwitcher<sup>®</sup>** to open and it will render the **CapSwitcher<sup>®</sup>** unable to operate, trip or close during this test program

- A. Substation Information: Record data about the location.
- B. Record the ratings of the **CapSwitcher<sup>®</sup>** being sure to include the resistor value.
- C. Receiving Inspection: Check for damages or shortages.
- D. Record the initial condition of the **CapSwitcher<sup>®</sup>**.
- E. **CapSwitcher<sup>®</sup>** Operational Test. This test can be performed with or without motion analyzing equipment.
  - E.1. Test for the close, **C**, and open, **O**, function by operating the close and open switches separately, these can be electrical buttons or a pistol grip switch.
  - E.2. To test **C-O** the **CapSwitcher<sup>®</sup>** must be in the open position. Operate the close and open switches one after the other.
  - E.3. For the **O-C** test the **CapSwitcher<sup>®</sup>** must be in the closed position. Operate the open and close switches one after the other.
- F. Contact Resistance Check: The contact resistance test should be performed. *Note: If readings are abnormal, check the terminal pad connections to ensure that the connection is not adding any additional resistance. Ensure that No-Ox ID A was used in making the joint.*
- G. Perform SF<sub>6</sub> leak tests per the SF<sub>6</sub> section of this instruction book.
- H. After performing the above tests (E-G) record the final reading on the mechanical counter and apply touch up paint if required.

# Installation & Adjustment

## **CapSwitcher<sup>®</sup>**

### Itemized Installation Checklist

Date of Installation: \_\_\_\_\_

#### A. Substation Information:

Location:		
Address:	City:	State:

#### B. **CapSwitcher<sup>®</sup>** Ratings Information:

System Voltage	kV
Closing Resistor Value	$\Omega$
Control Voltage	
Heater Voltage	
Operating pressure @20°C	52 psig nom, 32 psig min

#### C. Receiving Inspections: Check for damage or shortages

Material	Comments
Insulators	
Horizontal Base Frame	
Control Cabinet	
Support Column	
Spare Parts Box	
Other	

#### D. Column Checks

Item	Done (✓)
a. Switcher is installed on level columns	
b. Foundation bolts secured	
c. Ground leads secured to ground pads	

## Installation & Adjustment

### E. Record:

Record Initial Mechanical Operation Counter Number:	
Ambient Air Temperature:	°F / °C
SF <sub>6</sub> GAUGE (Temperature Compensated Pressure):	psig

### F. Cabinet Check:

Item	Done (√)
Inspect Field Wiring	
Cabinet Wiring Secure	
Check that all Mechanical Links Secure	
Note any parts on the floor of the cabinet. Are they important?	
Inspect Mechanism for loose parts	
Heaters, are they energized? And/or do the thermostats work?	

### H. Operational Tests

TESTS	PASS YES/NO	Comments
C		
O		

### I. Contact Resistance Check

	POLE 1	POLE 2	POLE 3
Contact Resistance (Less than 100 μΩ):			

## Installation & Adjustment

### J. SF<sub>6</sub> Leak Checks

	Leak YES/NO	Comments
SF <sub>6</sub> Gauge		
Insulator		
Rupture Disk		

### K. SF<sub>6</sub> Moisture Levels (Optional) (less than 300 ppm): Level \_\_\_\_\_ ppm

Record Final Mechanical Operations Counter:	Date:
---	-------

TOUCH UP PAINT AND WEATHER SEALANT	Date:
------------------------------------	-------

ADDITIONAL COMMENTS: \_\_\_\_\_

INSPECTION  
BY: \_\_\_\_\_

DATE OF  
INSPECTION: \_\_\_\_\_

WITNESS  
SIGNATURE: \_\_\_\_\_

## Recommended Inspection and Maintenance

### Recommended Inspection and Maintenance

The **CapSwitcher**<sup>®</sup> has been designed to operate with no maintenance. There are no lubrication points. Periodic inspection is important for satisfactory operation. Frequency of inspection and maintenance depends on the installation site, weather and atmospheric conditions, experience of operating personnel and special operation requirements.

Table 3: Recommended Installation and Maintenance Table

		Installation Tests	Patrolling Inspection 6 month	Routine 5 Year or 2000 Operations	Periodic 10 Year or 5,000 Operations
<b>Record</b>	Mechanism Counter	X	X	X	X
	Gas Pressure	X	X	X	X
	Ambient Temperature	X	X	X	X
<b>Insulators</b>	Contamination	X	X	X	X
	Damage	X	X	X	X
<b>Cabinet</b>	Any loose parts on the floor of the cabinet?	X	X	X	X
	Wiring Secure	X	X	X	X
	Links Secure	X	X	X	X
	Inspect Mechanism for loose parts	X	X	X	X
	Heaters Energized	X	X	X	X
<b>Mechanical</b>	Operational Tests	X		X	X
<b>Electrical</b>	Contact Resistance	X		X	X
<b>SF<sub>6</sub></b>	SF <sub>6</sub> Leak Checks	X		X	X
	Moisture Level	Optional		X	X
	Check Gauge	X		X	X
<b>Touch up Paint and Weather Sealant</b>		X		X	X
<b>Mechanism</b>	Inspect Trip Latch assembly			X	X
	Inspect Close Latch assembly			X	X
<b>Interrupter Inspection</b>	Inspect SF <sub>6</sub> seal for leaks				X
	Measure Contact Resistance				X
<b>Mechanical</b>	Timing Tests*				X

\*: These inspections **must** be completed by a trained Southern States Representative.

## Patrolling Inspection (6 Months)

The patrolling inspection is a largely visual inspection on an energized unit in service. The frequency of the inspection is determined by the local conditions and policies of the owner of the equipment. Refer to Table for recommended inspection items.

## Routine Inspection and Maintenance (5 year or 2000 operations)

**⚠ DANGER** The *CapSwitcher*<sup>®</sup> must be de-energized, isolated and grounded when performing this inspection. The Open and Close springs must be discharged with the switcher in the open position before attempting to perform this maintenance.

1. Refer to Table for recommended inspection items.
2. Follow instructions identified in Installation Test Procedure as appropriate.

## Periodic Inspection and Maintenance (10 year or 5,000 operations)

Current recommended Inspection and Maintenance Procedures require participation of a trained Southern States Representative.

**⚠ DANGER** The *CapSwitcher*<sup>®</sup> must be de-energized, isolated and grounded when performing this inspection. The Open and Close springs must be discharged with the switcher in the open position before attempting to perform this maintenance.

**⚠ DANGER** The *CapSwitcher*<sup>®</sup> must be de-gassed before proceeding with this inspection. Failure to comply can cause the resistor assembly to be thrown off the interrupter housing with great force causing death or injury to personnel and equipment in the area.

1. Follow instructions for the 5 year or 2000 operations Routine Inspection and Maintenance Procedure.
2. Perform timing tests and verify that the *CapSwitcher*<sup>®</sup> is within specifications.



**Southern  
States**

**The Quality Name in High Voltage Switching**

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