S C 2010 Circuit Switcher Instruction Manual

Contents

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Series 2000 Circuit-Switcher

Specifications

- Outdoor Transmission: 69 KV through 230 KV
- Reliable, economical switching and protection for transformers, single-shunt capacitor banks, line-connected and testing-connected shunt reactors, lines, and cables
- High interrupting ratings: 25-kA or 40-kA interrupting rating for 69-kV through 138-kV units, and 20-kA for 161-kV and 230-kV units
- A family of models for all station layouts, with or without integral disconnects
- Superior reliability and economy with a simple, straightforward design and fewer parts
- Hermetically sealed interrupters to eliminate the hassle and expense of field-filling with SF6
- Complete factory-assembly and checkout for quality assurance and reduced installation time
- Proven mechanical and electrical operating life with a 5-year warranty
- Select models meet high seismic requirements of IEEE Standard 693
- Available with optional features including interlocks, grounding switches, and bypass accessories

Product Usage Instructions

Installation
The Series 2000 Circuit-Switcher is designed for quick, inexpensive, and predictable installation. Follow the steps below

1. Choose an appropriate mounting location that offers the required mounting flexibility.
2. Ensure the area is clear of any obstructions and meets the necessary safety regulations.
3. Position the Circuit-Switcher in the desired location and secure it using the provided mounting hardware.
4. Connect the necessary electrical cables to the Circuit-Switcher following the provided wiring diagram.
5. Perform a thorough inspection of the installation to ensure all connections are secure and there are no visible

damages.

How it Works
The Series 2000 Circuit-Switcher operates in two modes: opening and closing.

Opening
When opening, follow these steps

1. Ensure the Circuit-Switcher is in the closed position.
2. Activate the opening mechanism using the provided control panel or switch.
3. Observe the Circuit-Switcher as it opens to confirm successful operation.

Closing
When closing, follow these steps

1. Ensure the Circuit-Switcher is in the open position.
2. Activate the closing mechanism using the provided control panel or switch.
3. Observe the Circuit-Switcher as it closes to confirm successful operation.

Frequently Asked Questions (FAQ)

- **Q: Why should I choose the Series 2000 Circuit-Switcher over other options?**
  A: The Series 2000 Circuit-Switcher offers reliable, economical switching and protection for various systems. It has high interrupting ratings, a simple design with fewer parts, hermetically sealed interrupters, and complete factory-assembly. It also comes with optional features and meets high seismic requirements.
- **Q: Is the Series 2000 Circuit-Switcher suitable for retrofit applications?**
  A: Yes, the Series 2000 Circuit-Switcher is ideal for both new and retrofit applications. It has a simple, straightforward design with fewer parts, lower purchase cost, lower operating cost, and can be retrofitted quickly with minimal disruption.

Aging assets are a barrier to the energy transition and the development of the future grid. This leaves customers faced with the challenge of upgrading aging equipment while increasing load capacity. Many customers believe upgrading these systems is expensive and time-consuming when in reality a high-performance equipment that can be retrofitted quickly with minimal disruption is needed.
Series 2000 Circuit-Switchers are a perfect solution to growing your grid because it is ideal where mounting flexibility is required. Series 2000 Circuit-Switchers have a simple, straightforward design with fewer parts, meaning lower purchase and operating costs, and complete factory-assembly, drastically reducing the installation time.

Introduction

WHY DO POWER USERS CHOOSE THE SERIES 2000 CIRCUIT-SWITCHER OVER ANY OTHER CIRCUIT SWITCHER?
Series 2000 Circuit-Switcher advances the state of circuit-switcher technology by bringing you breakthroughs, including:

- Reliable, economical switching and protection: For transformers, single-shunt capacitor banks, line-connected and testing-connected shunt reactors, lines, and cables

- High interrupting ratings: 25-kA or 40-kA interrupting rating for 69-kV through 138-kV units, and 20-kA for 161-kV and 230-kV units, allowing application on a wide variety of systems
- A family of models for all station layouts: With or without integral disconnects (Ideal for new or retrofit applications. Now available with pedestal heights up to 20 feet [607 cm])
- Superior reliability and economy: Simple, straightforward design with fewer parts means lower purchase cost and lower operating cost
- Interrupters: Hermetically sealed to eliminate the hassle and expense of field-filling with SF6, ensuring long, trouble-free life
- Complete factory-assembly and checkout: Pre-engineered modular construction assures quality, dramatically reduces installation time
- Superb mechanical and electrical operating life: Proven in the test lab and in the field, backed by a 5-year warranty
- Select models meet high seismic requirements of IEEE Standard 693: Critically important in high-seismic qualification level areas
- Available with optional features: Including a selection of interlocks, grounding switches, and bypass accessories

Table 1. Series 2000 Circuit-Switchers Interrupter Ratings for Transformer Switching and Protection Applications

Class	Qualifications	Maximum Amperes, Interrupting, RMS Symmetrical
Parallel switching	Not applicable	1200/2000 1
Load dropping 2	Not applicable	1200/2000 1
Fault interrupting 3	Primary faults 69 kV through 138 kV	25 000/40 000 4 5 6 7
Fault interrupting 3	Primary faults 161 kV and 230 kV	20 000 4 8 9
Fault interrupting 3	Secondary faults	4000 10 11
Fault interrupting 3	Internal faults	Refer to primary and secondary fault data listed earlier in this table

1. Depending on continuous current rating of circuit switcher.
2. Series 2000 Circuit-Switchers can close, carry, and interrupt the magnetizing current of the protected transformer.
3. The interrupting ratings shown are applicable for the following duty cycles: O or CO.
4. Tripping of a Series 2000 Circuit-Switcher must be coordinated with source-side protective equipment for short-circuit currents in excess of this value.
5. Rating is based on transient recovery voltage parameters defined in Table IIA of IEC Standard 56: 1987 for Series 2000 Circuit-Switchers rated 69 kV, and Table IID of IEC Standard 56: 1987 for Series 2000 Circuit-Switchers rated 115 kV through 138 kV.
6. At temperatures between –40°C and –30°C (–40° F and –22°F), circuit switchers with 25,000 ampere fault-interrupting rating are rated 20,000 amperes. Circuit switchers with 40,000 ampere fault-interrupting rating retain this rating from 40°C through +40°C (–40° F and –104°F).
7. Series 2000 Circuit-Switchers rated 40 kA fault interrupting are only tested and certified for transformer switching and
   protection applications.
8. At temperatures between –40°C and –30°C (–40° F and –22°F), the fault interrupting rating is 15,000 amperes.
9. Series 2000 Circuit-Switcher is suitable for transformer-primary applications where the inherent secondary-fault current— Cthe secondary-side fault current as reflected on the primary side of the transformer, assuming an infinite (zero-impedance) source—does not exceed 4000 amperes for a fault external to the transformer. The inherent secondary-fault current may be calculated as follows:
   - $$I = \frac{57.8P}{(\%Z)E}$$

     where I = Inherent secondary-fault current, amperes
   - P = Transformer self-cooled three-phase rating, kVA
   - E = Primary-side system phase-to-phase voltage, kV
   - %Z = Percent transformer primary-to-secondary impedance, referred to transformer self-cooled three-phase kVA rating
10. For applications where the inherent secondary-fault current exceeds the above limits, but where the maximum

expected fault current, based on transformer impedance plus source impedance (anticipating future system growth), is within these limits, refer to the nearest S&C Sales Office.

11. At temperatures between –40°C and –30°C (–40° F and –22°F), the secondary-fault interrupting rating of 161-kV and 230-kV Series 2000 Circuit-Switchers is 2000 amperes.

Table 2. Series 2000 Circuit-Switchers Interrupter Ratings for Line Switching Applications

Class	Qualifications	Maximum Amperes, Interrupting, R MS Symmetrical
Load splitting (parallel or loop switching)	Not applicable	1200/2000 1
Load dropping	Not applicable	1200/2000 1
Line dropping	69 kV through 138 kV	400
Line dropping	161 kV	320

1. Depending upon continuous current rating of the circuit switcher.

Table 3. Series 2000 Circuit-Switchers Interrupter Ratings for Cable Switching and Protection Applications

Class	Qualifications	Maximum Amperes, Interrupting, R MS Symmetrical
Load splitting (parallel or loop switching)	Not applicable	1200/2000 1
Load dropping	Not applicable	1200/2000 1
Cable dropping (charging current)	69 kV through 138 kV	400
Cable dropping (charging current)	161 kV	320
Fault interrupting 2	69 kV through 138 kV	25 000 3 4 5
Fault interrupting 2	161 kV	25 000 3 6 7

1. Depending upon continuous current rating of circuit switcher.
2. The interrupting ratings shown are applicable for the following duty cycles: O or CO.
3. Tripping of a Series 2000 Circuit-Switcher must be coordinated with source-side protective equipment for short-circuit currents in excess of this value.
4. Rating is based on transient recovery voltage parameters defined in Table IIA of IEC Standard 56: 1987 for Series 2000
   Circuit-Switchers rated 69 kV, and Table IID of IEC Standard 56: 1987 for Series 2000 Circuit-Switchers rated 115 kV
   through 138 kV.
5. At temperatures between –40°C and –30°C (–40° F and –22°F), circuit switchers with 25,000 ampere fault-interrupting rating are rated 20,000 amperes. Circuit switchers with 40,000 ampere fault-interrupting rating retain this rating from 40°C through +40°C (–40° F and –104°F).
6. Rating is based on transient-recovery-voltage parameters defined in Table 3 of ANSI Standard C37.06-1987.

7. At temperatures between –40°C and –30°C (–40° F and –22°F), the fault interrupting rating is 15,000 amperes.

Note: For qualifications on Series 2000 Circuit-Switchers interrupter ratings for series reactor switching applications, contact the nearest S&C sales office.

Table 4. Series 2000 Circuit-Switchers Interrupter Ratings for Single Shunt Capacitor-Bank Switching and Protection 1 2 Applications

Class	Qualifications	Maximum Amperes, Interrupting, RMS Symmetrical
Bank current switc hing	Grounded capacitor banks applied on solidly grou nded systems only, through 138 kV	400
Bank current switc hing	Ungrounded capacitor banks through 115 kV	400
Fault interrupting 3	Not applicable	25 000 4 5 6

1. S&C BankGuard Plus® Controls, described and listed in S&C Descriptive Bulletin 1011-30 and Specification Bulletin 1011-31, have the sensitivity to detect the first faulted unit in a capacitor bank, or to respond promptly to a shorted-turns fault in a shunt reactor, but with the discrimination to disregard system and bank unbalances, as well as spurious transients.
2. For applications on parallel (“back-to-back”) capacitor banks, refer to the nearest S&C Sales Office.
3. The interrupting ratings shown are applicable for the following duty cycles: O or CO.
4. Tripping of a Series 2000 Circuit-Switcher must be coordinated with source-side protective equipment for short-circuit
   currents in excess of this value.
5. Depending on continuous current rating of circuit switcher.
6. At temperatures between –40°C and –30°C (–40° F and –22°F), circuit switchers with 25,000 ampere fault-interrupting rating are rated 20,000 amperes. Circuit switchers with 40,000 ampere fault-interrupting rating retain this rating from –40°C through +40°C (–40° F and –104°F).

Table 5. Series 2000 Circuit-Switchers Interrupter Ratings for Shunt Reactor Switching and Protection 1 (Line-Connected or Tertiary-Connected Reactors)

Class	Qualifications	Maximum Amperes, Interrupting , RMS Symmetrical
Reactor Current Switching	Grounded reactors applied on solidly ground ed systems only, through 138 kV	600
Reactor Current Switching	Ungrounded reactors through 69 kV	600
Fault Interrupting 2	Not applicable	25 000 3 4 5

1. S&C BankGuard Plus® Controls, described and listed in S&C Descriptive Bulletin 1011-30 and Specification Bulletin 1011-31, have the sensitivity to detect the first faulted unit in a capacitor bank, or to respond promptly to a shorted-turns fault in a shunt reactor, but with the discrimination to disregard system and bank unbalances,

as well as spurious transients.

2. The interrupting ratings shown are applicable for the following duty cycles: O or CO.
3. Tripping of a Series 2000 Circuit-Switcher must be coordinated with source-side protective equipment for short-circuit currents in excess of this value.
4. Rating is based on transient-recovery-voltage parameters defined in Table IIA of IEC Standard 56: 1987 for Series 2000 Circuit-Switchers rated 69 kV, and Table IID of IEC Standard 56: 1987 for Series 2000 Circuit-Switchers rated 115 kV through 138 kV.
5. At temperatures between –40°C and –30°C (–40° F and –22°F), circuit switchers with 25,000 ampere fault interrupting rating are rated 20,000 amperes. Circuit switchers with 40,000 ampere fault interrupting rating retain this rating from 40°C through +40°C (–40° F and –104°F).

MODEL 2010

For low-profile substations where an integral disconnect for the circuit switcher is required, Model 2010 is ideal. This model features horizontal interrupters and a vertical-break disconnect. On Model 2010, shown in Figure 2, the disconnect is power operated in sequence with the interrupters.

FIGURE 2. A 138-kV Model 2010 Series 2000 Circuit-Switcher with horizontal interrupters and a vertical-break power-operated disconnect, applied for switching and protection of an oil-insulated shunt reactor at a substation belonging to a large southeastern utility.

Inset: One-line representation of the components in the image

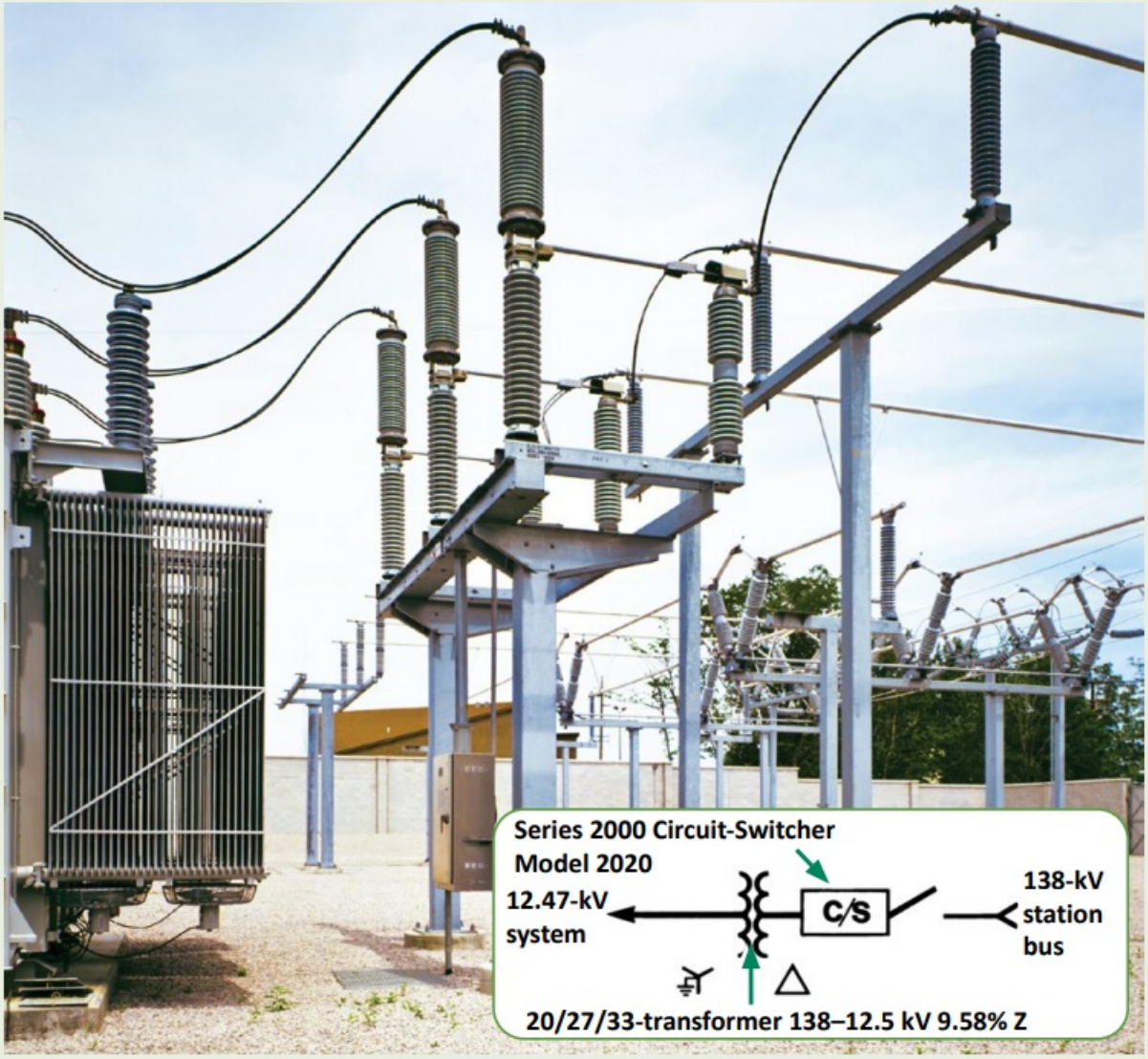
MODEL 2020

For substations where a low-profile circuit-switcher configuration is not a requirement, but where space is minimal and an integral disconnect is required, Model 2020 is the answer. This model uses vertical interrupters and a side-

break disconnect. It requires less space than low-profile-configuration Model 2010, and is also less expensive than this model because it uses shorter pole-unit bases and three fewer station post insulators. On Model 2020, shown in Figure 3, the disconnect is power operated in sequence with the interrupters.

FIGURE 3. A 138-kV Model 2020 Series 2000 Circuit-Switcher with vertical interrupters and a side-break power-operated disconnect, applied for transformer switching and protection at a midwestern utility substation.

Inset: A one-line representation of the components in the image.



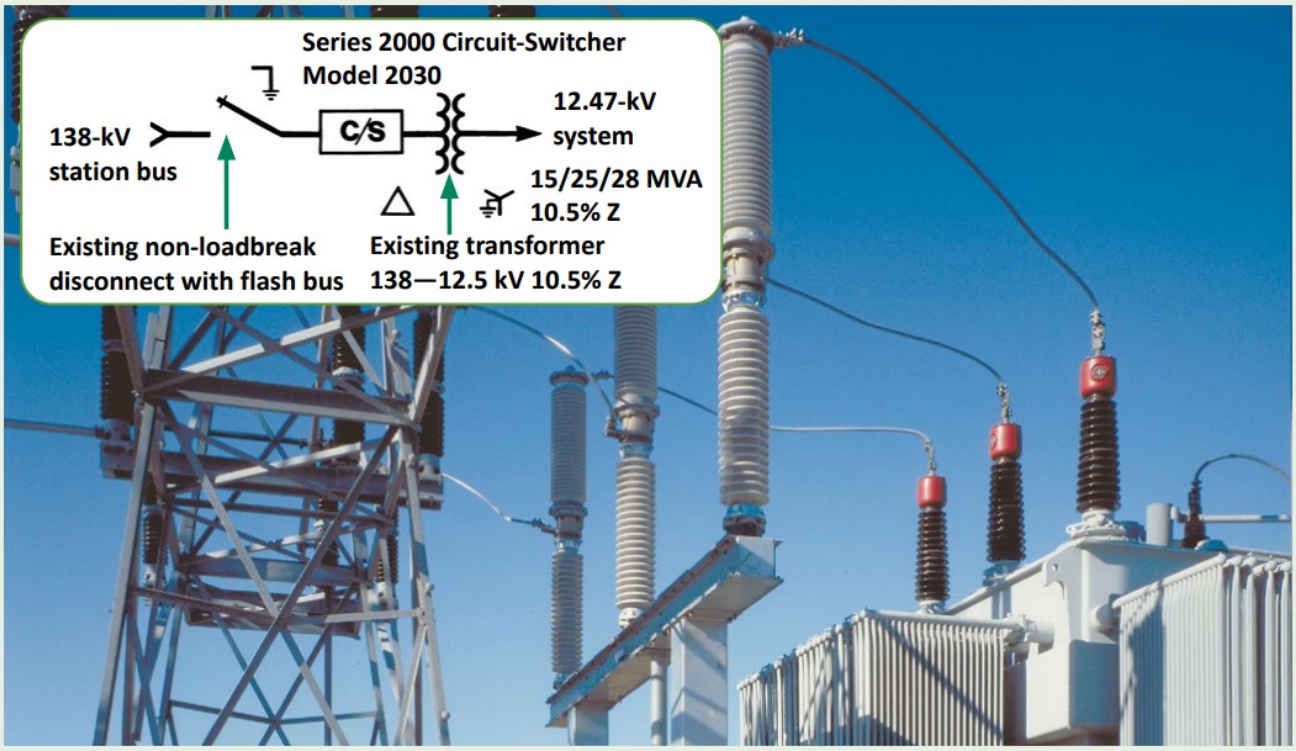
MODEL 2030

- Some circuit-switcher applications don't require an integral disconnect because there's already a separate disconnect installed in the substation. Such is often the case in retrofit installations, where a circuit switcher is desired to replace an existing fault interrupting scheme having capabilities that have been outgrown. An integral disconnect for the circuit switcher is also not needed in new installations where a separate disconnect is to be included in the layout and space is at a premium.
- For these applications, Model 2030 is ideal when a low-profile configuration is not necessary. This model features a vertical-interrupter design that can fit the tightest spaces.
- In the application shown in Figure 4, a Model 2030 was "shoehorned" into an existing layout where the distance between the transformer radiator and the footings for the non-loadbreak disconnect support structure measures a scant 7 feet (213 cm). (The Model 2030 supplanted the existing method of transformer protection, a "flash-bus" sacrificial switching scheme. Such schemes not only subject the system to maximum short-circuit

current by converting low-magnitude secondary-side faults to maximum primary-side faults, but they further subject the upstream transformer to through-fault stresses and require repetitive fault-interrupting operations by the upstream circuit breaker.)

FIGURE 4. A 138-kV Model 2030 Series 2000 Circuit-Switcher with vertical interrupters and without a disconnect supplanted an existing "flash-bus" sacrificial-switching scheme in this transformer switching and protection application at a large southwestern utility.

Inset: A one-line representation of the components in the image.

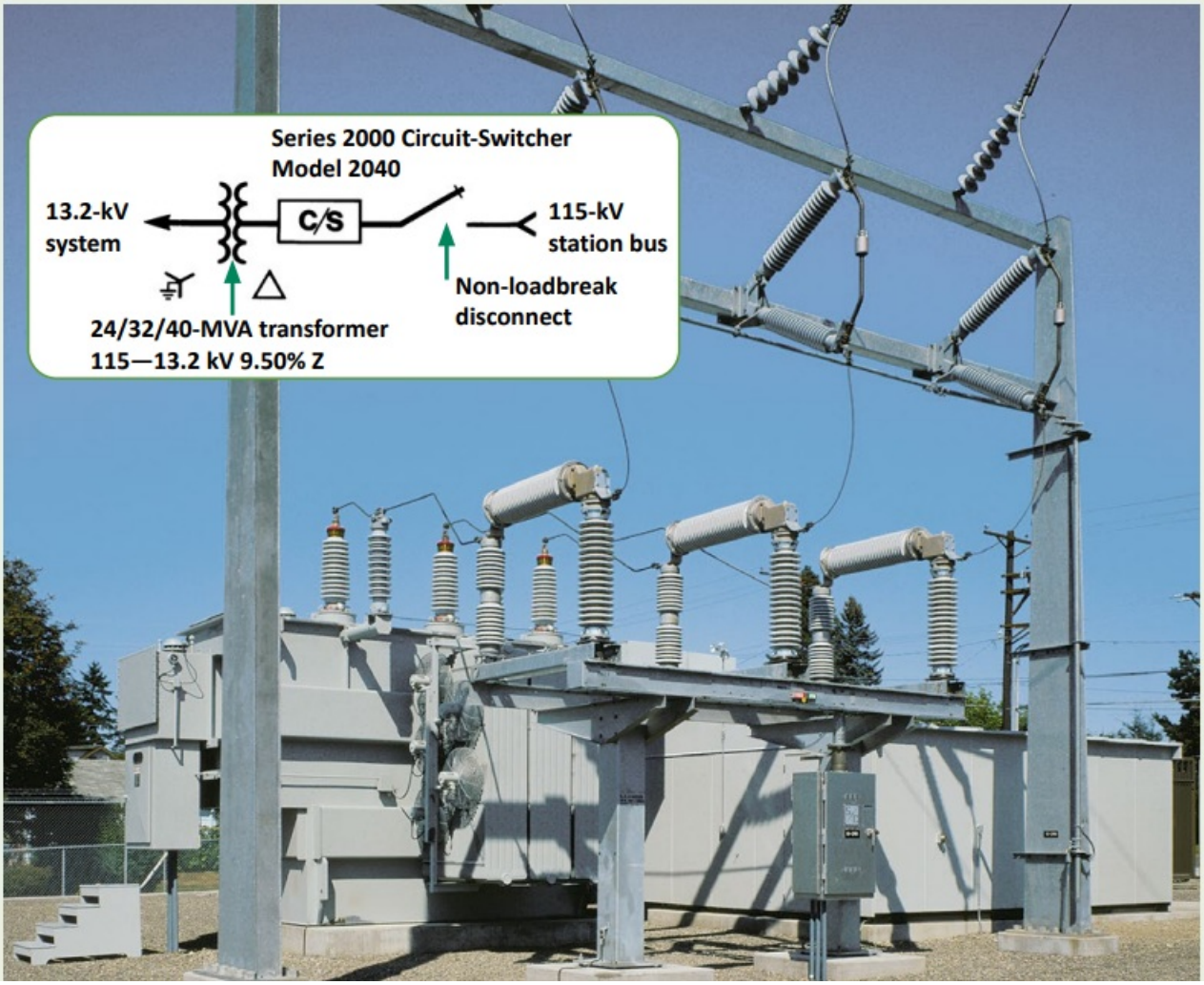


MODEL 2040

For low-profile substations that don't require a circuit switcher with an integral disconnect because a separate disconnect is used, Model 2040, with its horizontal interrupter design, is the ideal choice. In the application shown in Figure 5, a steel structure provides dead-ending for the incoming service and a disconnect for isolating the circuit switcher when required.

FIGURE 5. A 115-kV Model 2040 Series 2000 Circuit-Switcher Model 2040 with horizontal interrupters and without a disconnect applied for transformer switching and protection at a northwestern utility substation.

Inset: A one-line representation of the components in the image.

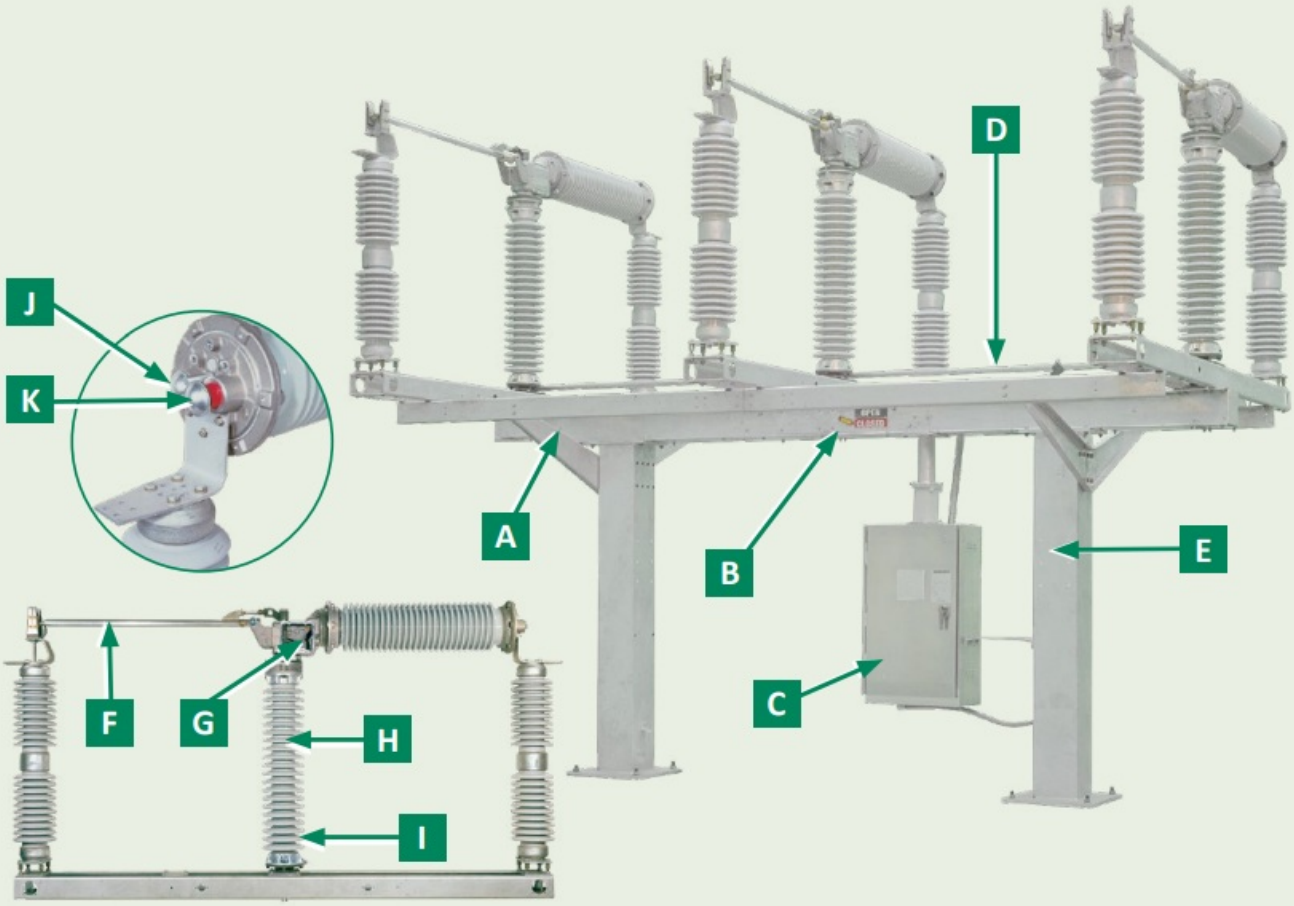


MODULAR CONSTRUCTION

IS THE KEY

- The unequaled variety of mounting configurations in which the Series 2000 Circuit-Switcher is offered is made possible through the extensive use of patented pre-engineered modular construction techniques.
- All models use a standardized interrupter, insulating support column, operator, and high-speed interrupter power train components. On disconnect-equipped Models 2010 and 2020, a low-speed disconnect power train is furnished that rotates the insulating support columns to open and close the disconnect. Horizontal interrupter Models2010 and 2040 include transfer linkages atop the insulating support columns that convert the vertical motion of the insulated operating rods into horizontal motion to drive the interrupters.
- This commonality of major components and simple, straightforward design make the Series 2000 Circuit-Switcher more economical to manufacture. And because there's a model tailored to fit the real estate and design requirements of every application, you can pick just the right model needed, and the savings can be substantial.

FIGURE 6. Construction details of a 138-kV Model 2010 Series 2000 Circuit-Switcher. Other models use similar major components.



- A High-speed interrupter power train enclosed in steel-sheathed box-type base. Permanently lubricated bearings are used throughout.
- B Switch-position indicator is readily visible at a distance.
- C Operator. See pages 10 and 11 for details.
- D Low-speed disconnect power train (on Models 2010 and 2020).
- E Mounting pedestals are furnished in 8-foot (2.4-m) height as standard. 10-foot (3.05-m) through 20-foot (6.1-m) high mounting pedestals are also available. When installed with S&C Anchor Bolts, a complete circuit switcher is capable of withstanding wind loadings up to 80 miles (129 k) per hour and seismic loadings up to 0.2 g ground acceleration, with the circuit switcher fully operational.
- F Vertical-break power-operated disconnect (on Model 2010) operates in sequence with the interrupter: After the interrupter has cleared the circuit, the disconnect opens to establish visible air gap. On a closing operation, the disconnect closes before the interrupter does. The disconnect current-carrying tongue contacts and associated multi-finger current-carrying jaw contacts are thus never subjected to any external arcing. A side-break power-operated disconnect (on Model 2020) coordinates the same way. 1
- G Transfer linkage (on Models 2010 and 2040) converts the vertical motion of the insulated operating rod into a horizontal motion to drive the interrupter operating rod.
- H Rugged galvanized steel pole-unit channel base (on Models 2010, 2020, and 2040) attaches quickly and easily to a high-speed interrupter power-train base and support arms.

- I Insulated operating rod reciprocating within a hollow insulating support column direct-drives the interrupter open and closed. Rotation of the support column opens and closes the disconnect (on Models 2010 and 2020). A patented special-grade lubricated dielectric filler permeates the rod/column-interior interface and prevents any inadvertent contamination from affecting dielectric integrity of operating rod or the column's interior. An aerator
  at the top of the column precludes water being "pumped in" because of pressure differentials caused by temperature cycling.
- J Precision pressure-relief device rapidly releases gas in the event of overpressure. Uses a unique cutter that pierces vent closure upon rupture of calibrated
  strain wire.
- K Go/no-go gas pressure indicator displays vivid-red target if gas pressure is too low for normal interrupting action.

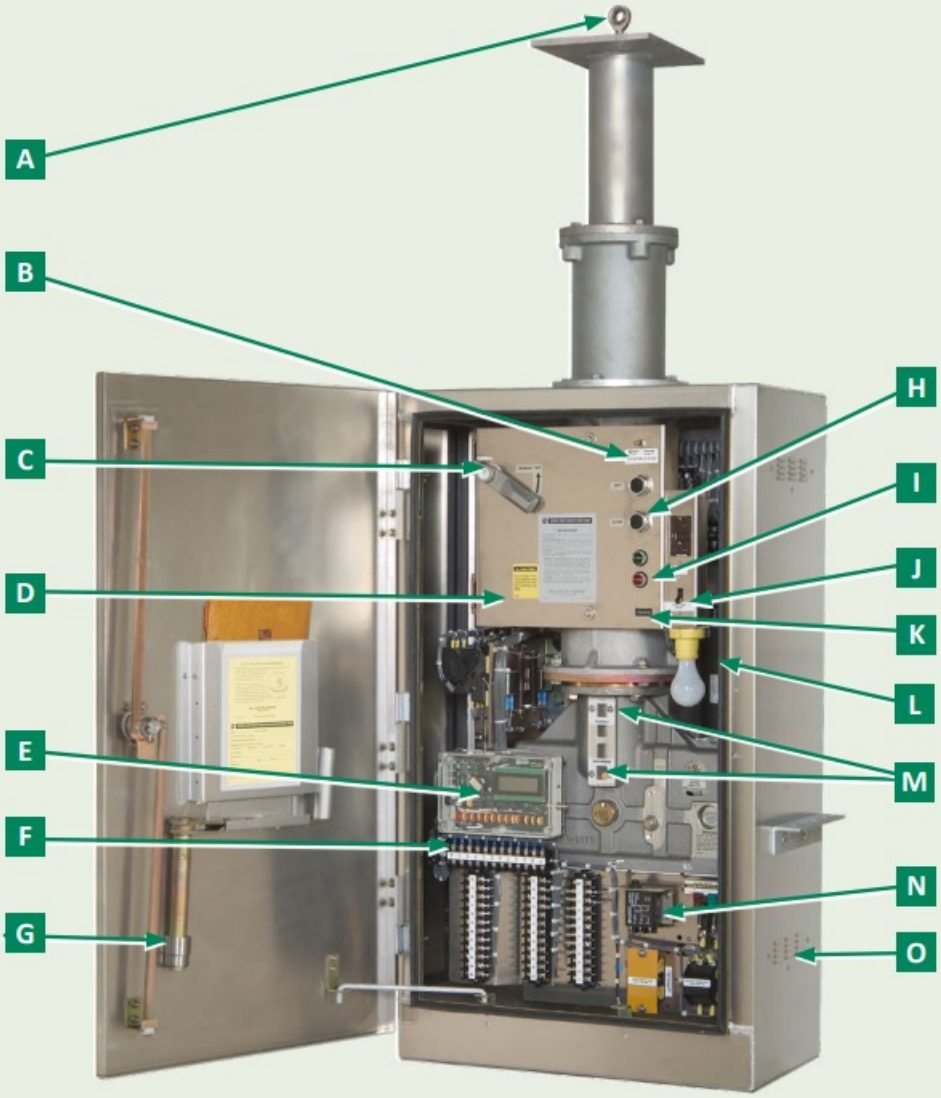
AN INTERRUPTER DESIGNED FOR SIMPLICITY AND RELIABILITY

- All Series 2000 Circuit-Switcher models use state-of-the-art single-gap SF6 puffer-type interrupters designed to close the circuit within six cycles and interrupt the circuit within six cycles and to maintain dielectric ratings when open. These dual-function interrupters are factory-filled to full pressure under controlled conditions and then permanently sealed. A unique sealing technique provides a zero leakage rate from –40°C to +40°C (–40°F to +104°F).
- Unlike the interrupters found on other devices, field-filling of Series 2000 Circuit-Switcher interrupters is neither necessary nor possible, thus eliminating the risk of contaminating the interrupting medium. A remote gas-density monitor is optionally available to coordinate with any remote alarm or SCADA monitoring system.
- Series 2000 Circuit-Switchers rated 69kV through 138kV are available with either a 25,000-ampere or 40,000-ampere primary-fault interrupting rating. Models rated 161kV and 230kV have a 20,000-ampere primary-fault interrupting rating. This heightened capability vastly expands the number of standalone applications for circuit switchers.

AN OPERATOR DESIGNED FOR PERFORMANCE

- Series 2000 Circuit-Switcher interrupters are driven by a single, stored-energy mechanism located at ground level in the operator. The operator directly drives the interrupters open and closed through a simple, high-speed power train leading from the top of the operator, through a horizontal interphase linkage enclosed in the steel-sheathed box-type base, to reciprocating-action insulated operating rods which pass through the center of hollow insulating support columns.
- On models having a power-operated disconnect— 2010 and 2020—the operator also drives the disconnect open and closed through a low-
  speed power train which rotates the insulating support columns.
- The mechanism in the operator features instantaneous trip-free capability… should the Series 2000 Circuit-Switcher be inadvertently closed into a fault sensed by user-furnished relaying, the mechanism will trip immediately. To accomplish trip-free operation, the mechanism uses two sets of springs—one for opening and one for closing. Both springs are motor-charged immediately following an opening operation, ready for the next closing operation.
- Charging time varies from 5 seconds to 16 seconds, depending on model and voltage.

FIGURE 7. Construction details of a typical operator furnished on Series 2000 Circuit-Switcher Models 2010 and 2020.



- A Connecting link drives the high-speed interrupter power train.
- B Local-remote selector switch (optional) prevents remote operation when a circuit switcher is being inspected.
- C Manual trip lever permits tripping the interrupters in the event operator control voltage has been lost.
- D Eight nonadjustable, single-pole double- throw auxiliary switch contacts (not visible in photo) follow the interrupters. Eight additional contacts are optional.
- E Remote gas-density monitor (optional) allows users to monitor the SF6 density in each interrupter. Includes two alarm relays that actuate when gas density drops below preset levels and a system status alarm relay.
- F Two individually adjustable auxiliary- switch contacts (on Models 2010 and 2020) follow the disconnect-blade power train and operator when coupled, operator only when decoupled.
- G Manual charging handle (on Models 2010 and 2020) lets users open the disconnect after the interrupters have been manually tripped in the event control power has been lost.
- H TRIP and CLOSE pushbuttons provide local electrical control of the circuit switcher.
- I Position-indicating lamps (optional) are wired in series with trip coil to give local indication of trip coil continuity as well as Open/Closed status of interrupters.
- J Duplex receptacle with ground-fault circuit interrupter and convenience-light lamp holder with switch (optional).

- K Non-reset electric operation counter
- L Motor charges stored-energy mechanism springs
- M Stored-energy mechanism indicators show at a glance the charged and discharged status of the stored-energy mechanism.
- N Trip-circuit-monitoring relay (optional) is wired in series with trip coil and verifies its continuity.
- O Weatherproof, dust-proof enclosure features front and side access doors provides easy access to all major components.

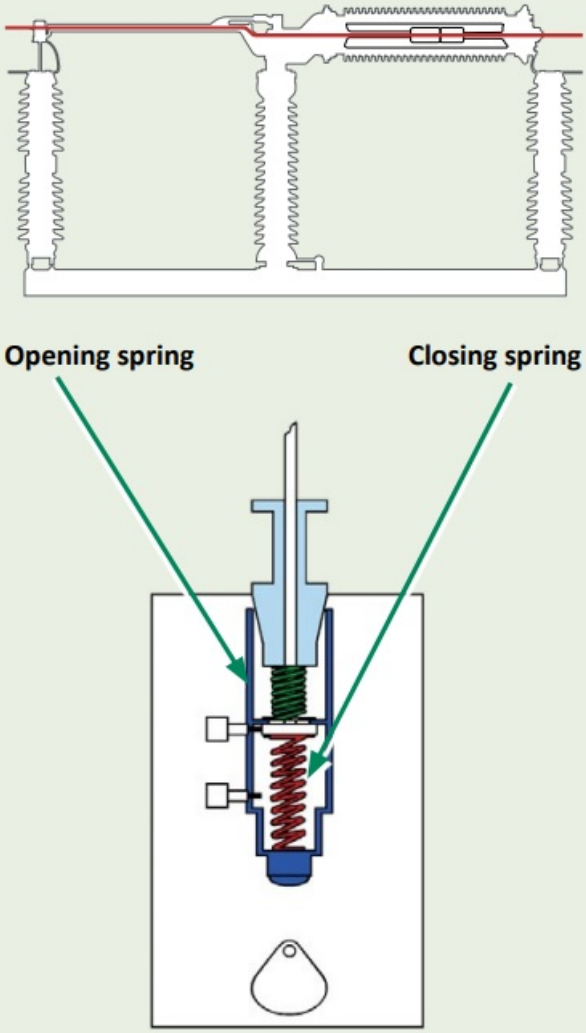
A variety of other options are available, including a space-heater thermostat, loss-of-voltage relays, anti-pump relays, and several types of key interlocks.

How it Works

OPENING

1. **Opening, Stage 1**
   With the circuit switcher closed and the interrupters carrying current, the opening spring in the operator stored-energy mechanism is charged (ready to trip) and the closing spring is discharged. See Figure 8. The switch position indicator on the high-speed interrupter power train base (see page 10) shows “CLOSED” and the stored-energy mechanism indicator in the operator (see Figure 7 on page 13) shows “CHARGED.”

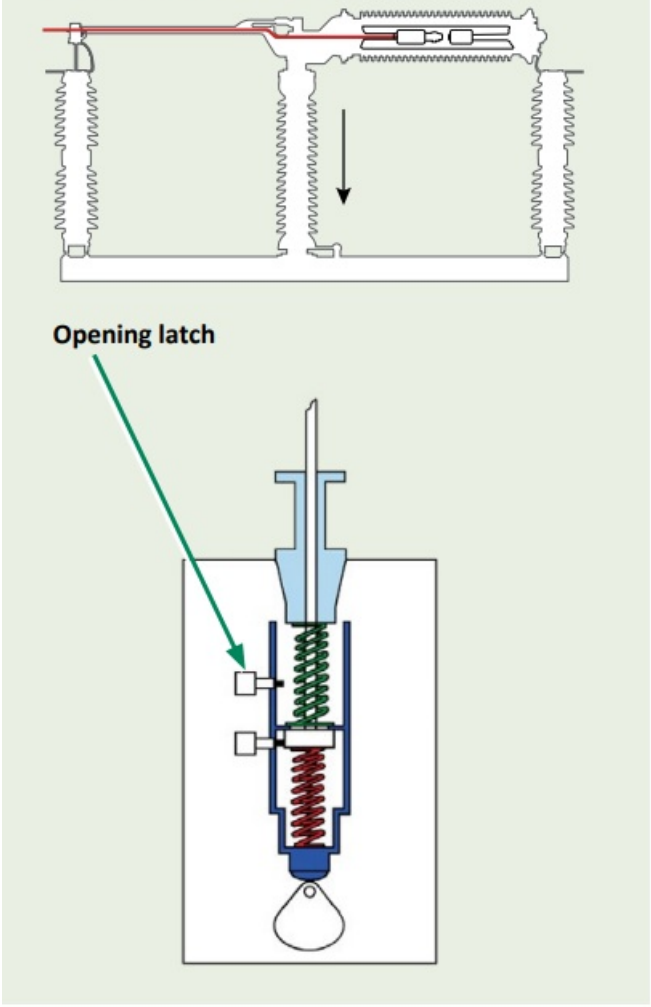
FIGURE 8. Switch opening, stage 1.



2. **Opening, Stage 2**

   When the circuit switcher is called upon to trip, the opening latch in the stored-energy mechanism is released. See Figure 9. The opening spring immediately discharges, forcing the operator connecting link downward to drive the high-speed interrupter power train to the Open position, thus tripping the interrupters. The switch-position indicator on the high-speed interrupter power train base shows “OPEN” and the stored-energy mechanism indicator in the operator shows “DISCHARGED.”

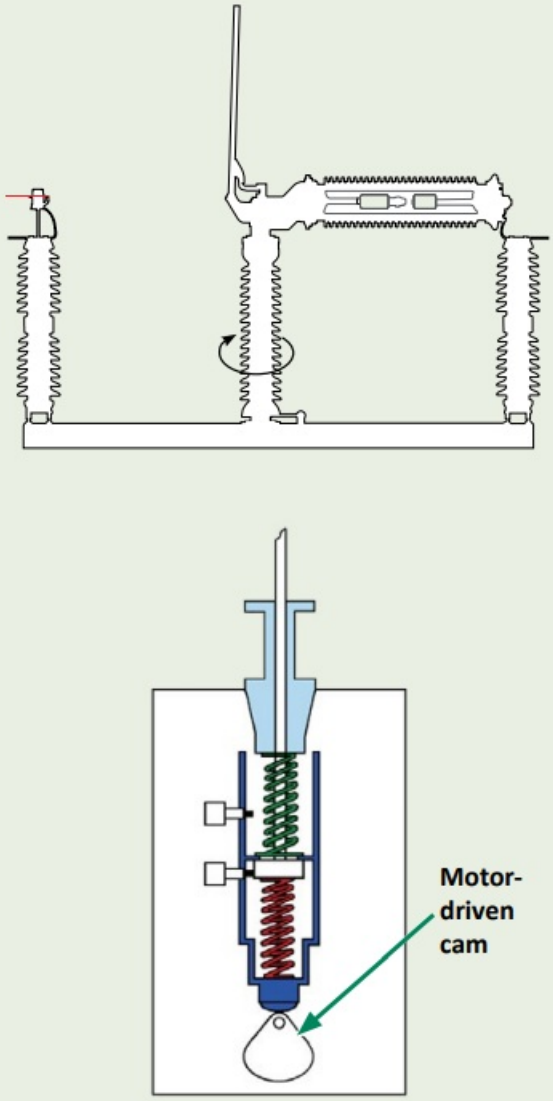
FIGURE 9. Switch opening, stage 2.



3. **Opening, Stage 3**

   The motor-driven cam in the stored-energy mechanism rotates, charging both the opening spring and the closing spring. See Figure 10. Simultaneously, on Models 2010 and 2020 that have a power-operated disconnect, the low-speed disconnect power train rotates the insulating support columns to open the disconnect. The switch-position indicator on the high-speed interrupter power train base still shows “OPEN” but the stored-energy mechanism indicator in the operator now shows “CHARGED.”

FIGURE 10. Switch opening, stage 3.

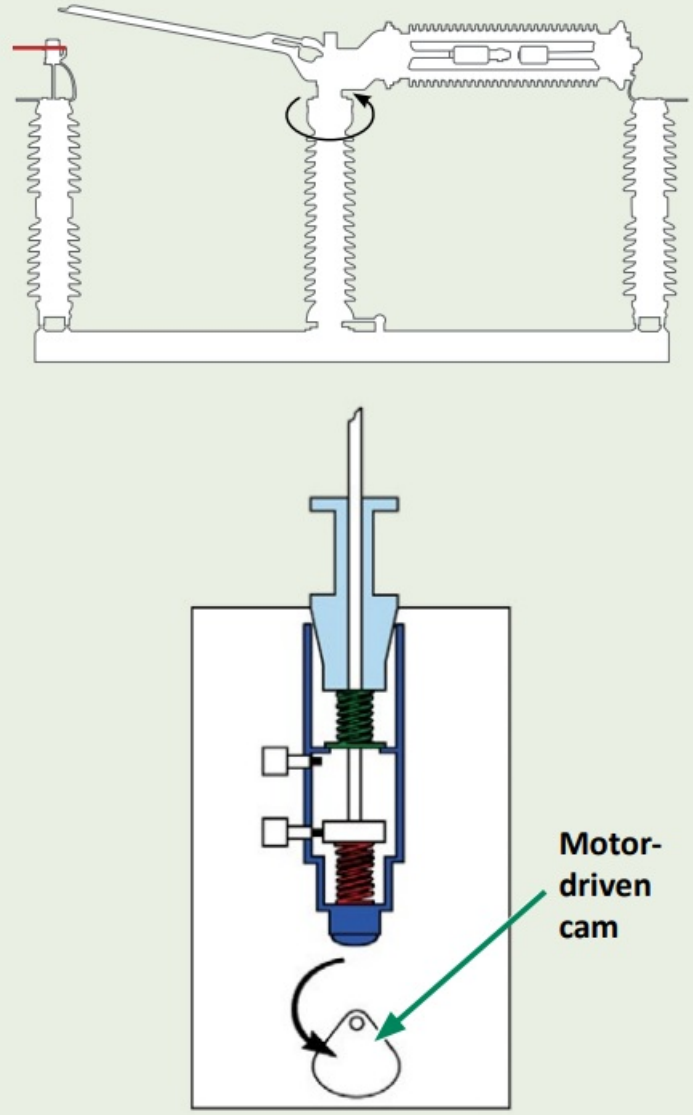


CLOSING

1. **Closing, Stage 1**

   When the circuit switcher is called upon to close, the motor-driven cam in the stored-energy mechanism rotates out of the way. See Figure 9. Simultaneously, on Models 2010 and 2020 that have a power-operated disconnect, the low-speed disconnect power train rotates the insulating support columns to close the disconnect. The switch position indicator on the high-speed interrupter power train base still shows “OPEN” and the stored-energy mechanism indicator in the operator still shows “CHARGED.”

FIGURE 11. Switch closing, stage 1.

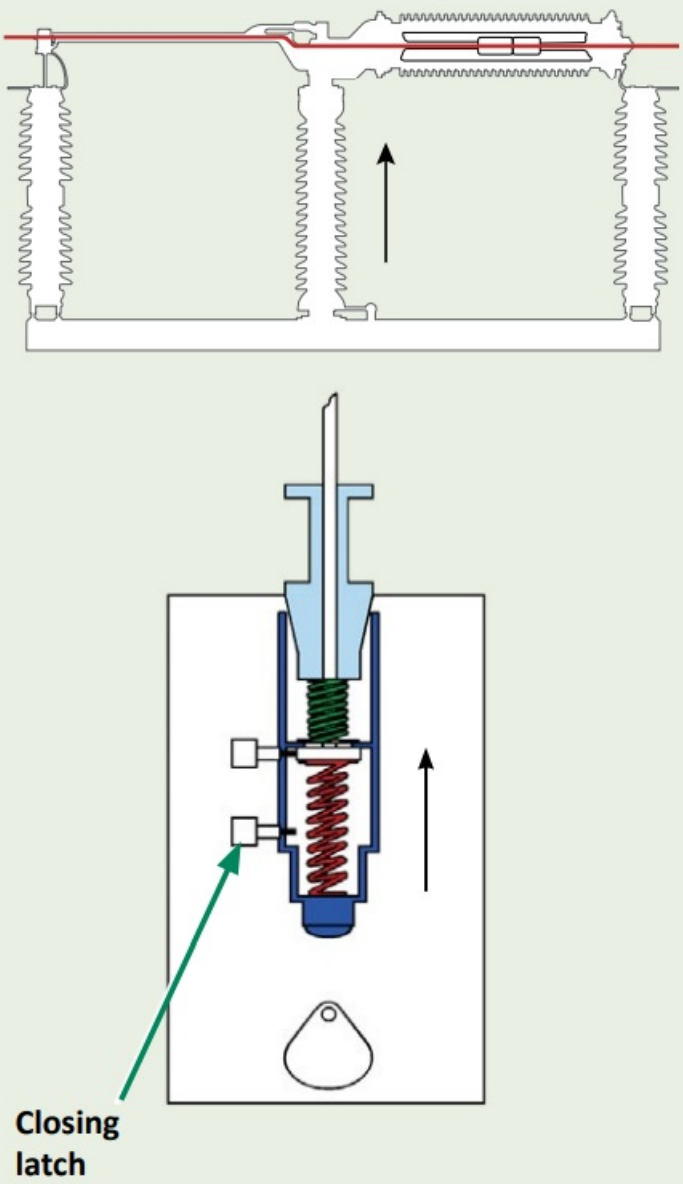


2. **Closing, Stage 2**

   After the disconnect has closed, the closing latch in the stored-energy mechanism is released. See Figure 12. The closing spring immediately discharges, forcing the operator connecting link upward to drive the high-speed interrupter power train to the Closed position, thus closing the interrupters. The switch-position indicator on the high-speed interrupter power train base shows “CLOSED” but the stored-energy mechanism indicator in the operator still shows “CHARGED.”

   Because the opening spring remains charged throughout the closing sequence, trip-free operation is provided should the circuit switcher inadvertently close into a fault.

FIGURE 12. Switch closing, stage 2.



INSTALLATION IS QUICK, INEXPENSIVE, AND PREDICTABLE

- Each Series 2000 Circuit-Switcher is completely assembled, adjusted, and tested at the factory. It's then disassembled only to the extent necessary for shipment. Series 2000 Circuit-Switchers are packed and shipped with major components fully assembled, so field assembly time is drastically reduced, averaging 4 hours or less for the Model 2030 shown in Figure 13. User installation cost savings are enormous! No costly time-consuming field adjustments are necessary, either.
- Start-up is quick, too. With Series 2000 Circuit-Switchers, no factory-service checkout is required before placing the installation into service.

UNPRECEDENTED FACTORY-TESTING

- Each Series 2000 Circuit-Switcher's operating speed and simultaneity are checked at the factory. During opening and closing, the interrupters must operate within 0.1 cycles of each other on models rated 69 kV through 138 kV, 0.25 cycles of each other on models rated 161 kV and 230 kV. Because the power train is not changed in any way after this test, simultaneity of operation is ensured when the circuit switcher is installed in

the field.

- Mechanical operating tests consisting of 25 Open and close operations verify each Series 2000 Circuit-Switcher's performance.

FIGURE 13. Each Series 2000 Circuit-Switcher is fully assembled, adjusted, and tested at the factory before shipment.

- Each Series 2000 Circuit-Switcher interrupter receives numerous leak tests using an ultra-sensitive "sniffer" capable of detecting minute traces of SF6 gas. And before each Series2000 Circuit-Switcher is packed for shipment,
  its interrupters are final-checked for leaks. All Series 2000 interrupters are "sealed for life," eliminating the need for field-filling and associated gas-handling requirements. These sealed interrupters allow users to more easily comply with existing voluntary U.S. SF6 emission-reduction programs.

FIGURE 14. Assembling, adjusting, and testing at the factory ensures fast, trouble-free field installation and operation.

SERIES 2000 CIRCUIT-SWITCHER PROVIDES SUPERIOR RELIABILITY

Its simplified design and complete factory-assembly and testing mean that Series 2000 Circuit-Switcher can be relied upon to function properly day in and day out. And S&C's comprehensive easy-to-follow inspection recommendations, keyed to typical transformer inspection schedules, ensure the Series 2000 Circuit-Switcher's continuing proper performance. Series 2000 Circuit-Switcher's reliability is backed up by a 5-year warranty!

CONTACT YOUR S&C SALES REPRESENTATIVE FOR MORE INFORMATION

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Documents / Resources

S C 2010 Circuit Switcher [pdf] Instruction Manual
2010, 2020, 2030, 2040, 2010 Circuit Switcher, Circuit Switcher, Switcher

References

- S&C Electric Company
- User Manual