

Operation

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Introduction

Qualified Persons

WARNING

The equipment covered by this publication must be installed, operated, and maintained by qualified persons who are knowledgeable in the installation, operation, and maintenance of underground electric power distribution equipment along with the associated hazards. A qualified person is one who is trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from nonlive parts of electrical equipment
- The skills and techniques necessary to determine the proper approach distances corresponding to the voltages to which the qualified person will be exposed
- The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment

These instructions are intended only for such qualified persons. They are not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

Read this Instruction Sheet

NOTICE

Read this instruction sheet thoroughly and carefully before installing or operating your S&C IntelliRupter fault interrupter. Familiarize yourself with the Safety Information and Safety Precautions on pages 4 through 8. The latest version of this publication is available online in PDF format at sandc.com/Support/Product-Literature.asp.

Retain this Instruction Sheet

Instruction sheets covering the installation and operation of S&C Vista SD Underground Distribution Switchgear are included in the “Installation and Operation Information Kit” provided with each switchgear assembly. A catalog dimensional drawing showing cable-locating and anchor-bolt dimensions is also provided in the information kit. All personnel involved with the installation and operation of the gear should be thoroughly familiar with the contents of the kit.

This instruction sheet covers the operation of S&C Vista SD Underground Distribution Switchgear. Along with this instruction sheet are copies of:

- S&C Instruction Sheet 695-505, “S&C Vista SD Underground Distribution Switchgear: *Installation*”
- S&C Instruction Sheet 695-590, “S&C Vista SD Underground Distribution Switchgear: *Inspection Recommendations*”
- Reference drawings detailing the installation of cable-support brackets and wiring diagrams for the CTs (provided if the switchgear assemblies contain at least one fault interrupter) and the auxiliary contacts (provided if the switchgear assemblies contain at least one factory-installed motor operator or if catalog number suffix “-Sx” has been specified, where “x” is the way on which the auxiliary contacts are installed)

A variety of optional features is available for S&C Vista SD Underground Distribution Switchgear. The catalog number stamped on the nameplate affixed to the unit is suffixed with letter-number combinations applicable to the gear furnished. Refer to Appendix D starting on page 30 for descriptions of optional features.

This instruction sheet is a permanent part of your S&C Vista SD Underground Distribution Switchgear. Designate a location where you can easily retrieve and refer to it.

Proper Application

⚠ WARNING

The equipment in this publication must be selected for a specific application. The application must be within the ratings furnished for the equipment.

Warranty

The warranty and/or obligations described in S&C's standard conditions of sale, as set forth in Price Sheet 150, plus any special warranty provisions, as set forth in the applicable product-line specification bulletin, are exclusive. The remedies provided in the former for breach of these warranties shall constitute the immediate purchaser's or end user's exclusive remedy and a fulfillment of all seller's liability. In no event shall the seller's liability to the immediate purchaser or end user exceed the price of the specific product that gives rise to the immediate purchaser's or end user's claim. All other warranties, whether express or implied or arising by operation of law, course of dealing, usage of trade or otherwise, are excluded. The only warranties are those stated in Price Sheet 150, and THERE ARE NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY EXPRESS WARRANTY OR OTHER OBLIGATION PROVIDED IN PRICE SHEET 150 IS GRANTED ONLY TO THE IMMEDIATE PURCHASER AND END USER, AS DEFINED THEREIN. OTHER THAN AN END USER, NO REMOTE PURCHASER MAY RELY ON ANY AFFIRMATION OF FACT OR PROMISE THAT RELATES TO THE GOODS DESCRIBED HEREIN, ANY DESCRIPTION THAT RELATES TO THE GOODS, OR ANY REMEDIAL PROMISE INCLUDED IN PRICE SHEET 150.

**Warranty
Qualifications**

The seller's standard warranty does not apply to components not of S&C manufacture that are supplied and installed by the purchaser or to the ability of the seller's equipment to work with such components.

Safety Information

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels and tags attached to your S&C Vista SD Underground Distribution Switchgear. Familiarize yourself with these types of messages and the importance of these various signal words:

DANGER

“DANGER” identifies the most serious and immediate hazards that *will likely* result in serious personal injury or death if instructions, including recommended precautions, are not followed.

WARNING

“WARNING” identifies hazards or unsafe practices that *can* result in serious personal injury or death if instructions, including recommended precautions, are not followed.

CAUTION

“CAUTION” identifies hazards or unsafe practices that *can* result in minor personal injury or product or property damage if instructions, including recommended precautions, are not followed.

NOTICE

“NOTICE” identifies important procedures or requirements that *can* result in product or property damage if instructions are not followed.

Following Safety Instructions

If you do not understand any portion of this instruction sheet and need assistance, contact your nearest S&C Sales Office or S&C Authorized Distributor. Their telephone numbers are listed on S&C’s website sandc.com, or call the S&C Global Support and Monitoring Center at 1-888-762-1100.

NOTICE

Read this instruction sheet thoroughly and carefully before operating your S&C Vista SD Underground Distribution Switchgear.

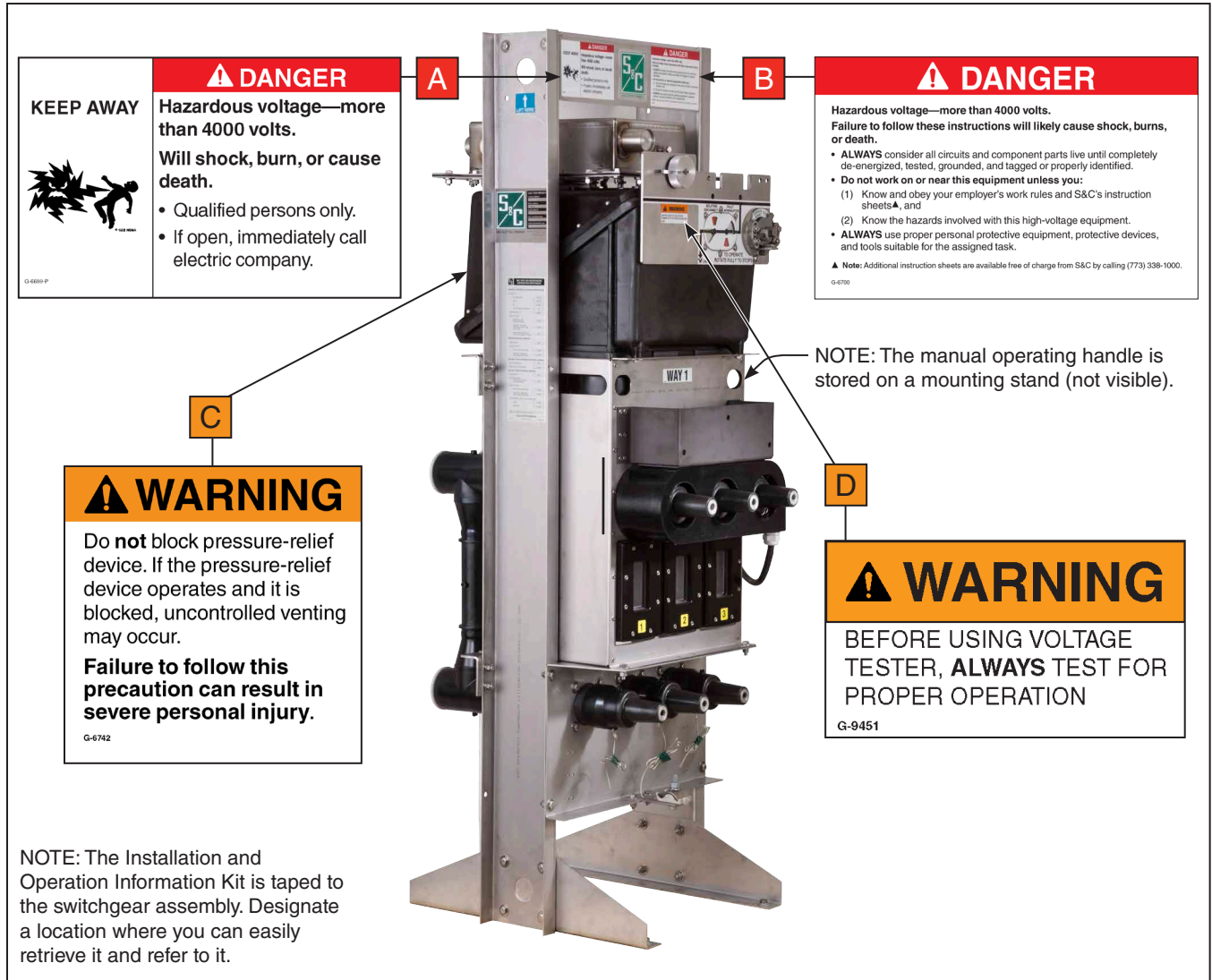


Replacement Instructions and Labels

If you need additional copies of this instruction sheet, contact your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

It is important that any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

Location of Safety Labels and Tags

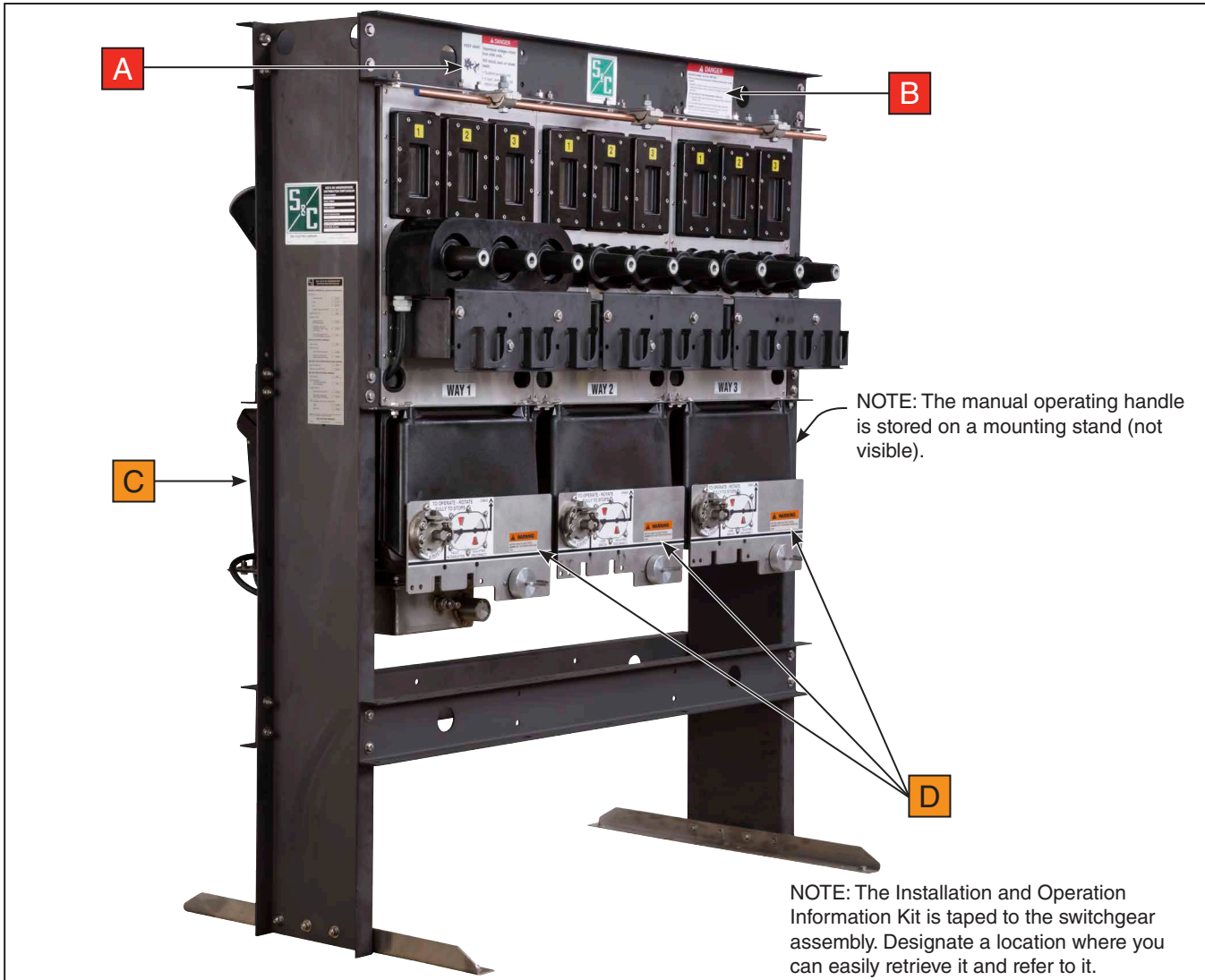


Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Number
A	DANGER	Keep Away—Hazardous Voltage (“Mr. Ouch”)	G-6699
B	DANGER	Hazardous Voltage—Always Consider Circuits and Components Live...	G-6700
C	WARNING	Do Not Block Pressure-Relief Device (not visible)	G-6742
D	WARNING	Before Using Voltage Tester—Always Test for Proper Operation	G-9451

Figure 1. Location of Safety Labels — Model 101 (single-way) vault-mounted style unit shown.

Location of Safety Labels and Tags



Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Number
A	⚠ DANGER	Keep Away—Hazardous Voltage (“Mr. Ouch”)	G-6699
B	⚠ DANGER	Hazardous Voltage—Always Consider Circuits and Components Live...	G-6700
C	⚠ WARNING	Do Not Block Pressure-Relief Device (not visible)	G-6742
D	⚠ WARNING	Before Using Voltage Tester—Always Test for Proper Operation	G-9451

Figure 2. Location of Safety Labels — Model 321 (3-way) vault-mounted style unit shown.

Location of Safety Labels and Tags



Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Number
A	⚠ DANGER	Keep Away–Hazardous Voltage (“Mr. Ouch”)	G-6699
B	⚠ DANGER	Hazardous Voltage–Always Consider Circuits and Components Live...	G-6700
C	⚠ WARNING	Do Not Block Pressure-Relief Device (not visible)	G-6742
D	⚠ WARNING	Before Using Voltage Tester–Always Test for Proper Operation	G-9451
E	⚠ WARNING	Keep Out–Hazardous Voltage Inside	G-6398

Figure 3. Location of Safety Labels — Model 321 (3-way) pad-mounted style unit shown.

DANGER



S&C Vista SD Underground Distribution Switchgear operates at high voltage. **Failure to observe these precautions will result in serious personal injury or death.**

Some of these precautions may differ from your company's operating procedures and rules. Where a discrepancy exists, follow your company's operating procedures and rules.

1. **Qualified Persons.** Access to the Vista SD Underground Distribution Switchgear must be restricted only to qualified persons.
2. **Safety Procedures.** Always follow safe operating procedures and rules. Always maintain proper clearance from energized components.
3. **Personal Protective Equipment.** Always use suitable protective equipment such as rubber gloves, rubber mats, hard hats, safety glasses, and arc-flash clothing in accordance with safe operating procedures and rules.
4. **Doors.** High-voltage compartment doors must be securely closed and latched with padlocks in place at all times unless work is being performed inside the enclosure.
5. **Key Interlocks.** Optional key interlocks, if furnished, must be in place. Check the operating sequence of the key interlocks to verify proper sequencing. After the switchgear is installed, destroy all duplicate keys or make them accessible only to authorized persons so the key-interlock scheme will not be compromised.
6. **Opening Doors.** Do not apply any undue force when attempting to open a door. The use of undue force may damage the door-latching mechanism.
7. **Safety Labels.** Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "NOTICE" labels.
8. **Energized Bushings.** Always assume the bushings are energized unless proven otherwise by test, by visual evidence of an open-circuit condition at the load-interrupter switch or fault interrupter, or by observing that the load-interrupter switch or fault interrupter is grounded.
9. **Backfeed.** Bushings, cables, load-interrupter switches, and fault interrupters may be energized by backfeed.
10. **Grounding.**
 - Vista SD switchgear must be connected to a suitable earth ground before energizing and at all times when energized.
 - The ground wire(s) must be bonded to the system neutral, if present. If the system neutral is not present, proper precautions must be taken to ensure the local earth ground cannot be severed or removed.
 - After the switchgear has been completely disconnected from all sources of power and tested for voltage, properly ground the load-interrupter switches and fault interrupters before touching any bushings or components that are to be inspected, replaced, serviced, or repaired.
11. **Load-Interrupter Switch or Fault-Interrupter Position.**
 - Always confirm the **Open/Closed** position of the load-interrupter switch or fault interrupter by visually observing the position of the isolating disconnect.
 - The load-interrupter switch or fault interrupter may be energized by backfeed.
 - The load-interrupter switch or fault interrupter may be energized in any position.
12. **Maintaining Proper Clearance.** Always maintain proper clearance from energized components.

S&C Vista SD Underground Distribution Switchgear features load-interrupter switches and microprocessor-controlled fault interrupters for the switching and protection of 600-ampere main feeders and 200- or 600-ampere taps, laterals, and sub-loops. These elbow-connected components are encapsulated in an environmentally friendly solid-dielectric insulating material. Vista SD switchgear is available in ratings through 29 kV and 16 kA symmetrical interrupting. See Figures 4 and 5 on pages 10 and 11.

S&C Vista SD Underground Distribution Switchgear is considerably smaller than traditional air-insulated gear; it can be installed exactly where it's needed. It's completely submersible and thus suitable for installation in subsurface vaults subject to flooding. Single-way Vista SD assemblies are ideally suited for application on the primary side of network transformers. Multi-way assemblies—from three to six load-interrupter switches or fault interrupters—are also available.

S&C Visi-Gap load-interrupter switches use a vacuum interrupter in series with a manually operated two-position isolating disconnect for three-pole live switching of 600-ampere three-phase circuits. Load-interrupter switches comply with IEEE Standard 1247 and IEC Standard 62271-103. They feature an easy-to-operate manual operating mechanism.

S&C Visi-Gap fault interrupters use a vacuum interrupter in series with a manually operated two-position isolating disconnect for three-pole load switching of 200- or 600-ampere circuits and fault interrupting through 16 kA symmetrical at 17.5 kV and through 12.5 kA symmetrical at 29 kV. Fault interrupters comply with both IEEE Standard C37.60 and IEC Standard 62271-111.

Load-interrupter switches and fault interrupters can be directly opened and closed using the manual handle furnished; they can also be operated remotely using a piece of rope attached to the manual handle or by a user-furnished universal pole of the appropriate length, equipped with a standard fitting. Opening and closing speed of the vacuum interrupters is not dependent upon the speed with which the handle is moved. Operating shafts are padlockable in either position.

Factory-installed and wired motor operators, to facilitate remote power operation of load-interrupter switches and fault interrupters, are optionally available. They can be decoupled from the operating mechanisms to permit testing without changing the positions of the switches or fault interrupters. The motor operators require a user-furnished 100-240 Vac 50/60-Hz control power source; they're controlled from a hand-held, cable-connected portable remote control pendant.

Easy-to-follow mimic bus and indicators on the front of the switchgear convey the positions of the load-interrupter switches and fault interrupters (and their isolating disconnects), and whether a fault interrupter has tripped on a fault. The default color scheme is green for the OPEN/RESET indicator and red for the CLOSED indicator. These colors will be reversed (i.e., green for the CLOSED indicator and red for the OPEN/RESET indicator) if catalog number suffix “-J1” has been specified.

Large viewing windows provide a clear view of the isolating disconnects, allowing operating personnel to easily confirm the positions of the load-interrupter switches and fault interrupters.

Terminals are equipped with field-replaceable 600-ampere rated bushing adapters. Fault interrupters may be optionally equipped with 200-ampere bushing-well adapters in lieu of 600-ampere bushing adapters. Bushing and bushing-well adapter interfaces conform to IEEE Standard 386 and accept all standard insulated connectors and inserts recognized by this standard.

The self-powered overcurrent control can be programmed using a personal computer connected to the control through an adapter cable. The control features a variety of fuse and relay time-current characteristic (TCC) curves that comply with IEEE Standard C37.112.

Components

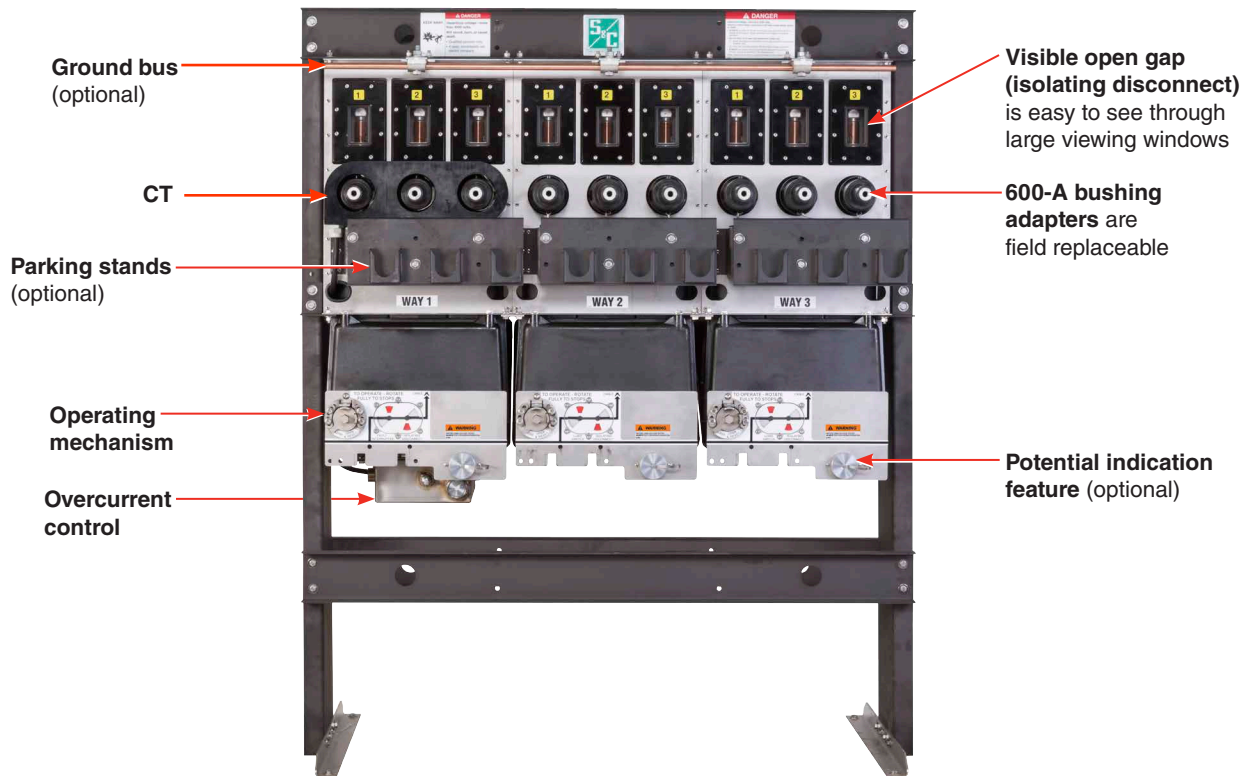


Figure 4. S&C Vista SD switchgear has the features and options needed to match user needs. Model 321 (3-way) vault-mounted style unit shown with cables at top, operating mechanism at bottom (Catalog Number Suffix “-V1”).

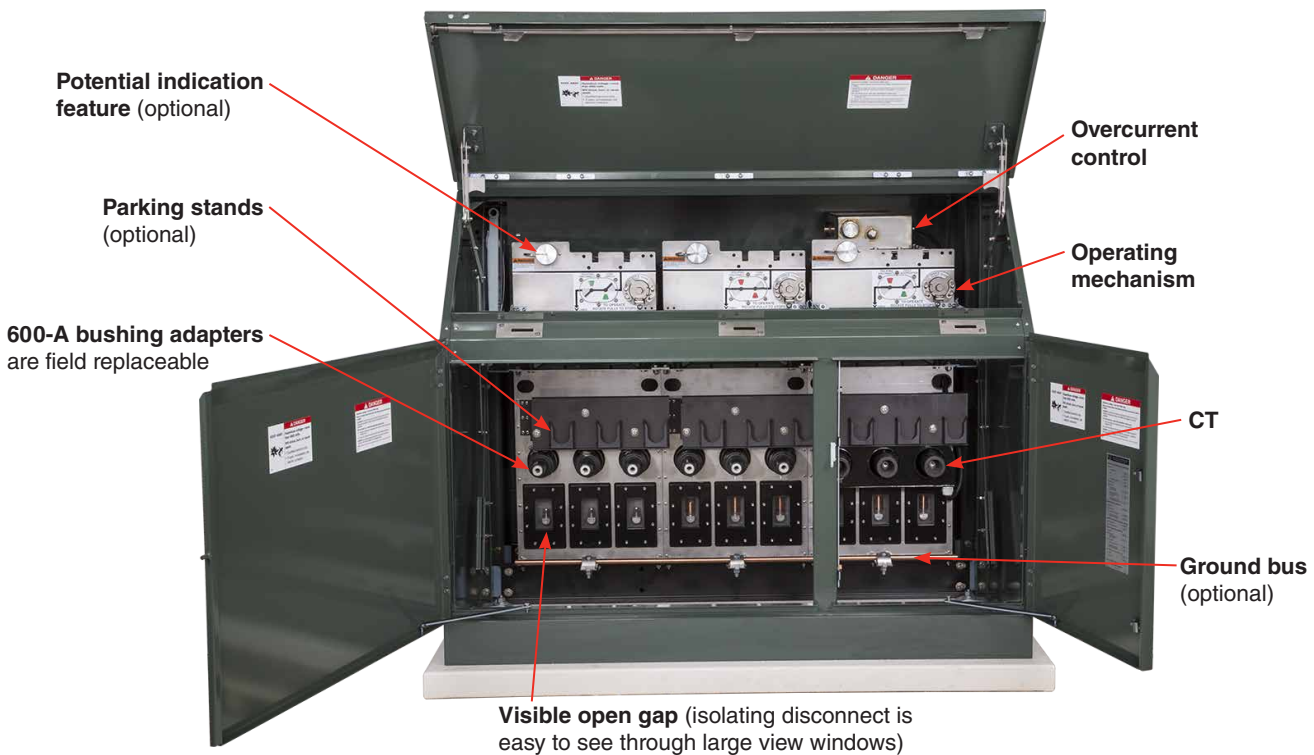


Figure 5. S&C Vista SD switchgear has the features and options needed to match user needs. Model 321 (3-way) pad-mounted style unit shown (Catalog Number Suffix “-P1”).

Manually Opening or Closing Visi-Gap Load-Interrupter Switches and Visi-Gap Fault Interrupters

NOTICE

If the load-interrupter switch or fault interrupter is equipped with a motor operator, refer to S&C Instruction Sheets 695-520, "S&C Vista SD Underground Distribution Switchgear: *Installation and Operation of Vista SD Motor Operator*," and 695-525, "S&C Vista SD Underground Distribution Switchgear: *Vista SD Portable Remote Control Pendant*."

Vault-Mounted Style

STEP 1. Retrieve manual operating handle from its storage location on the side of the mounting frame. The handle is tethered to the switchgear assembly to prevent its removal. See Figure 6.

STEP 2. Attach the manual handle to the shaft of the operating mechanism. Rotate the handle in the appropriate direction firmly, and without hesitation, all the way to the stops. See Figure 7.

- (a) To open the load-interrupter switch or fault interrupter, rotate handle *counterclockwise*.
- (b) To close the load-interrupter switch or fault interrupter, rotate handle *clockwise*.

The manual operating handle may be operated from a variety of locations using a rope, a shotgun stick, or by hand (illustrated).

STEP 2. Check the position indicators to confirm that the load-interrupter switch or fault interrupter is in the desired position (open or closed). See Figure 8.

STEP 3. Confirm the position of the isolating disconnect using the large viewing window. See Figure 9.

STEP 4. Return the manual operating handle to its storage location on the side of the mounting stand, taking care to position the tether out of the way.



Figure 6. The manual operating handle stored on a mounting stand.

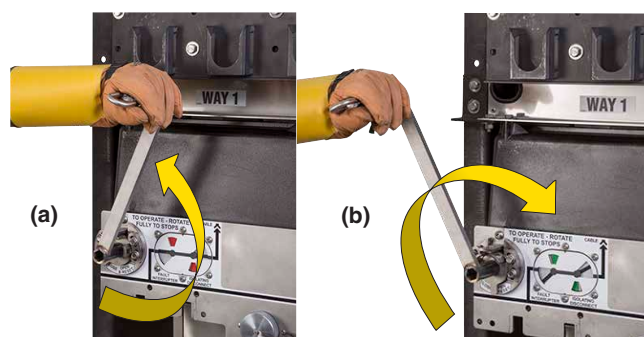


Figure 7. Rotate the manual handle counterclockwise to open (a), clockwise to close (b).

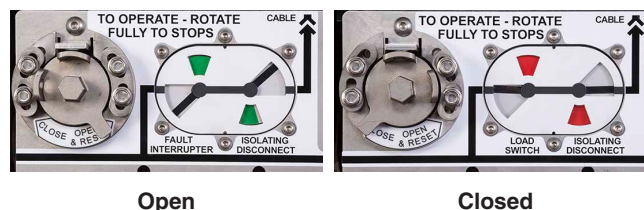


Figure 8. Indicators and mimic bus show position of load-interrupter switch or fault interrupter.



Figure 9. Visible-open gap (isolating disconnect) is easy to see through large viewing windows

Operation

Pad-Mounted Style

- STEP 1.** Remove the padlock from the gear. See Figure 3 on page 7.
- STEP 2.** Insert a pentahead socket wrench or tool (a hex-head socket wrench or tool when catalog number suffix “-H1” is specified) into the hinged roof latching mechanism. Rotate the wrench or tool 360° *counterclockwise* to unlatch the hinged roof. See Figure 10.

NOTICE

Do not apply any undue force when attempting to open the hinged roof or a door. The use of undue force may damage the latching mechanism.



Figure 10. Unlatching the pentahead bolt latching mechanism with a pentahead socket wrench—a 360° counterclockwise turn will unlock the hinged roof.

- STEP 3.** Lift the hinged roof all the way open; the “hold-open” latching mechanism will engage automatically. See Figure 11.

WARNING

After lifting the roof open and ensuring the “hold-open” latching mechanism is engaged, release pressure on the hinged roof slowly. Failure to engage the “hold-open” latching mechanism could result in personal injury.



Figure 11. Lift the hinged roof to engage the “hold-open” latching mechanism.

- STEP 4.** To gain access to the termination compartment, lift the latch handle to open the right-side door or the center door. See Figure 12(a). Open the door far enough to permit the door-holder mechanism to engage automatically.
- STEP 5.** To open the left-side door, lift the finger latch. See Figure 12(b). Open the door far enough to permit the door-holder mechanism to engage automatically.

NOTICE

Optional pad-mounted style enclosures furnished on switchgear assemblies with five or six ways have three doors. The right-side door and the center door have lift-style latch handles. The left-hand door has a finger latch.

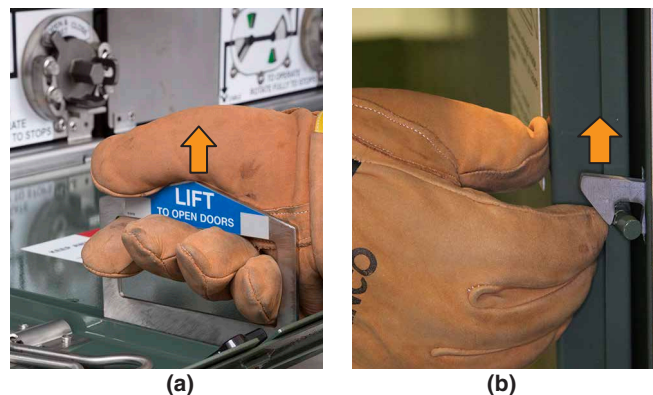


Figure 12. To gain access to the termination compartment, lift the latch handle to open the right-side door (a), and then lift the finger latch to open the left-side door (b).

STEP 6. Retrieve the manual operating handle from its storage location at the top-left side of the switchgear assembly. The handle is tethered to the switchgear assembly to prevent its removal. See Figure 13.

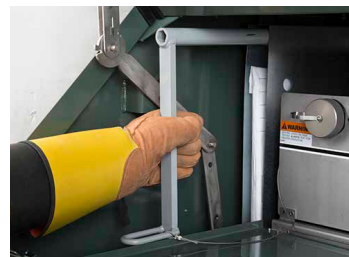


Figure 13. Remove the operating handle from the storage location.

STEP 7. Rotate the manual operating handle guide ring to the active (up) position. See Figure 14(a). Insert the manual operating handle through the guide ring; attach the handle to the shaft of the operating mechanism. See Figure 14(b).

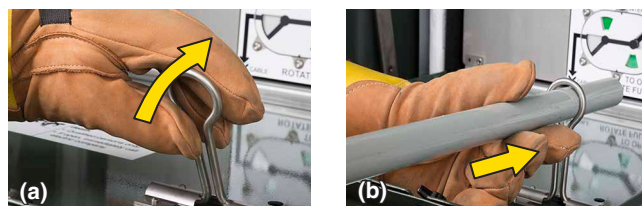


Figure 14. Rotate the operating handle guide ring to the active (up) position (a); insert the handle through the guide ring and attach it to the shaft of the operating mechanism.

STEP 8. To operate the load-interrupter switch or fault interrupter, rotate the operating handle in the appropriate direction firmly, and without hesitation, all the way to the stops. See Figure 15.

- (a) To open the load-interrupter switch or fault interrupter, rotate the handle *counterclockwise*.
- (b) To close the load-interrupter switch or fault interrupter, rotate the handle *clockwise*.

The manual operating handle may be operated from a variety of locations using a rope, a shotgun stick, or by hand (illustrated).

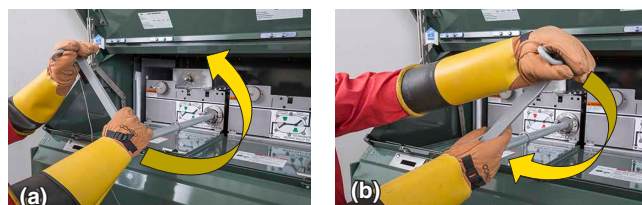


Figure 15. Rotate the operating handle *counterclockwise* to open (a), *clockwise* to close (b).

STEP 9. Check the position indicators to confirm the load-interrupter switch or fault interrupter has been operated successfully. See Figure 16.

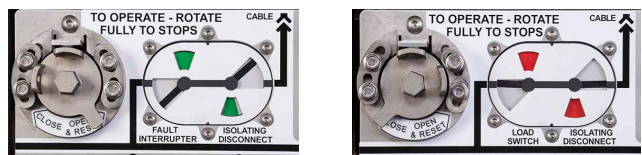


Figure 16. Indicators and mimic bus show the position of the load-interrupter switch or fault interrupter.

STEP 10. Confirm the position of the isolating disconnect using the large viewing window. See Figure 17.

STEP 11. Return the manual handle to its storage location, taking care to position the tether out of the way. Be sure the tether is completely inside the enclosure before closing the doors and the hinged roof.



Figure 17. The visible-open gap (isolating disconnect) is easy to see through large viewing windows.

Operation

Closing the Doors and the Hinged Roof

- STEP 1.** Lift the door-holder mechanism up to allow left-side door to swing closed. See Figure 18. Make sure the finger latch engages the pin. See Figure 12(b) on page 12.
- STEP 2.** Lift the door-holder mechanism up to allow right-side door or the center door to swing closed. See Figure 18. Close the door completely. Make sure the latch handle drops down fully to engage the door-latching mechanism.
- STEP 3.** On the right side of the switchgear enclosure, while pushing up on the hinged roof, release the latch on the “hold-open” mechanism. See Figure 19. Allow the hinged roof to sag against the “hold-open” mechanism. At the other end of the enclosure, push up on the hinged roof just enough to allow that “hold-open” mechanism latch to be released. Lower the hinged roof into the **Closed** position.
- STEP 4.** Insert a pentahead socket wrench or tool (or a hex-head socket wrench or tool if catalog number suffix “-H1” is specified) into the hinged roof latching mechanism. Rotate the wrench or tool 360° *clockwise* to fully latch the hinged roof. See Figure 20.
- STEP 5.** Insert the padlock shackle through the hole in the padlock recess and lock the padlock.



Figure 18. Lift the door-holder mechanism up to allow the door to swing closed.

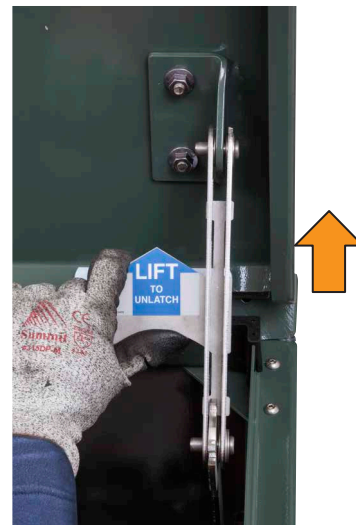


Figure 19. While pushing up on the hinged roof, release the latch on the “hold-open” mechanism.



Figure 20. To fully latch the hinged roof, rotate pentahead socket wrench or tool 360° *clockwise*.

Resetting Visi-Gap Fault Interrupters (All Styles)

STEP 1. Check the POSITION indicators to confirm the fault interrupter has tripped. See Figure 21.

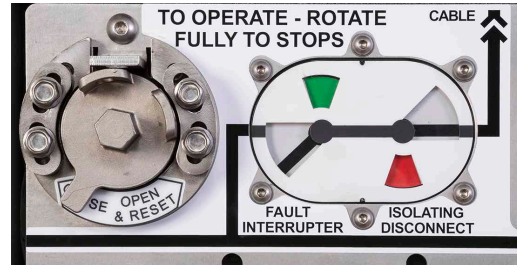


Figure 21. The POSITION indicator after a fault has occurred. The fault interrupter is open, and the isolating disconnect is closed.

STEP 2. Retrieve the manual operating handle from its storage location. Attach the handle to the shaft of the operating mechanism. Rotate the handle *counter-clockwise* firmly, and without hesitation, all the way to the stops to reset the fault interrupter. See Figure 22.

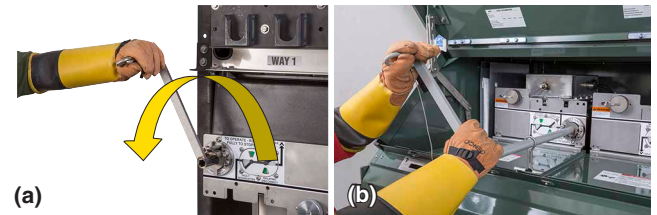


Figure 22. Resetting the fault interrupter after a fault: (a) vault-mounted style (b) pad-mounted style.

STEP 3. Check the POSITION indicators to confirm the fault interrupter has been opened. See Figure 23.

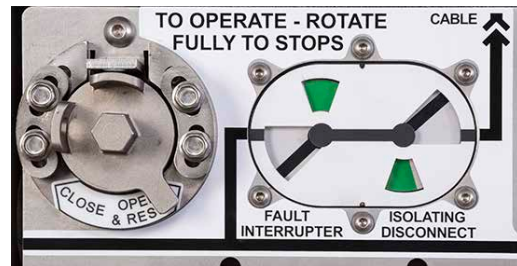


Figure 23. The POSITION indicator after the fault interrupter has been opened and reset.

STEP 4. Confirm the position of the isolating disconnect using the large viewing window. See Figure 24.

STEP 5. Return the manual operating handle to its storage location, taking care to position the tether out of the way.



Figure 24. The isolating disconnect after the fault interrupter has been opened and reset.

Operation

STEP 6. Repair the fault in accordance with your company's operating procedures and rules.

STEP 7. When you are ready to re-energize the circuit, rotate the manual operating handle *clockwise* to close the fault interrupter. See Figure 25.

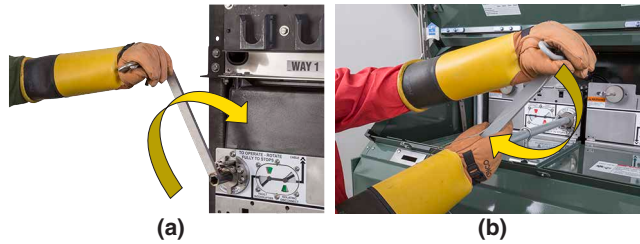


Figure 25. Closing the fault interrupter: (a) vault-mounted style (b) pad-mounted style.

STEP 8. Check the POSITION indicators to confirm the fault interrupter is closed. See Figure 26.

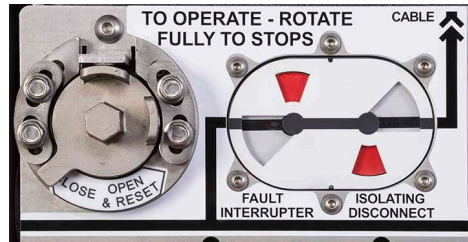


Figure 26. The POSITION indicator after the fault interrupter has been closed.

STEP 9. Confirm the position of the isolating disconnect using the large viewing window. See Figure 27.

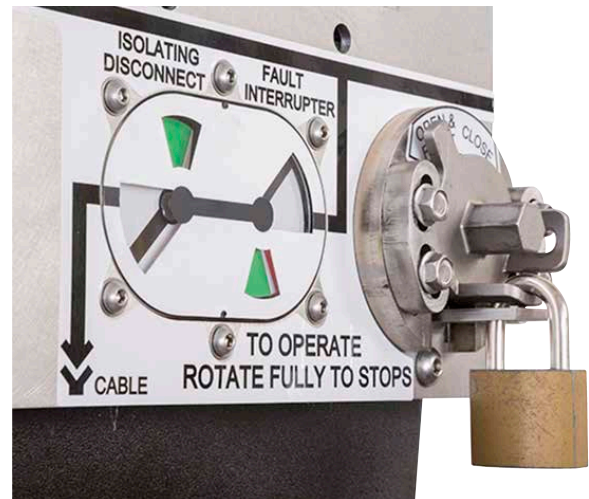


Figure 27. The isolating disconnect after the fault interrupter has been closed.

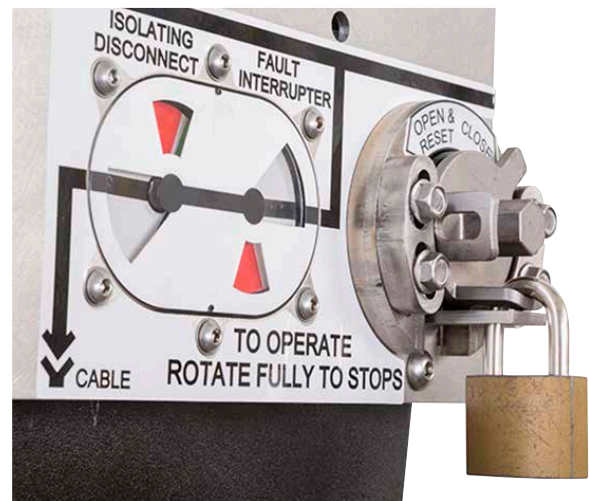
STEP 10. Return the manual operating handle to its storage location, taking care to position the tether out of the way.

Locking in Open or Closed Position

To prevent operation of a load-interrupter switch or fault interrupter, insert a padlock through the operating mechanism and the center hole in the locking collar. See Figure 28.



(a) Locked open



(b) Locked closed

Figure 28. The loadinterrupter switches or fault interrupters may be padlocked in either position.

Operation

Checking for Voltage Using the Optional Potential Indication Feature

WARNING

Before using the **Potential Indication** feature, always test for proper operation. If the **Potential Indication** feature is not operating properly, test for voltage using an alternate method.

NOTICE

The **Potential Indication** feature uses a capacitor voltage divider with a ratio of 2400:1. A line-to-neutral voltage of 7.2 kV will read approximately 3.0 Vac on the voltmeter. Accuracy of the **Potential Indication** feature is approximately +/-8%.

- STEP 1.** Using water and mild soap, if necessary, clean the surface of the operating mechanism front panel around the **Potential Indication** feature. Petroleum-based solvents should not be used on or around Vista SD Underground Distribution Switchgear.
- STEP 2.** Unscrew the aluminum cap covering the **Potential Indication** feature. See Figure 29.
- STEP 3.** Attach a high-impedance true RMS-reading voltmeter, set to read ac volts, between Test Jacks 1, 2, or 3, and the Neutral Jack to read the phase-to-neutral voltage, or between Test Jacks 1 and 2, 2 and 3, or 3 and 1, to read the phase-to-phase voltage. See Figure 30. A reading on the meter greater than 0.5 Vac indicates voltage is present at the bushing. A reading on the meter less than 0.5 Vac indicates there is no voltage at the bushing. No reading on the meter means the **Potential Indication** feature or the voltmeter may not be operating properly. Check for voltage using an alternate method.



Figure 29. The Potential Indication feature with the cover removed.



Figure 30. Check for voltage.

Low-Voltage Phasing Using Optional Voltage-Indication Feature

- STEP 1.** Using water and mild soap, if necessary, clean the surface of the operating mechanism front panel around the **Potential Indication** feature. Petroleum-based solvents should not be used on or around Vista SD Underground Distribution Switchgear.
- STEP 2.** Unscrew the aluminum cap covering the **Voltage-Indication** feature.
- STEP 3.** Using a high-impedance true RMS-reading voltmeter, set to read ac volts, determine the phase-to-neutral voltage for each phase of the two ways to be phased as follows:
- Set the voltmeter for volts ac.
 - Connect one of the test probes of the voltmeter to the Neutral Jack of the way to be phased.
 - Place the other test probe on each of the test jacks, in turn, of the two ways to be phased and measure the phase-to-neutral voltage. See Figure 31 (a), (b), and (c).
 - If the voltage measured at each test jack is greater than 0.5 Vac and they are equal, proceed to Step 4 on page 20.
 - If the voltage measured at any of the test jacks is less than 0.5 Vac, the phases are not energized and phasing cannot be performed. If the voltages measured are not equal, the voltmeter may not be operating properly. Phasing should be performed using an alternate method.

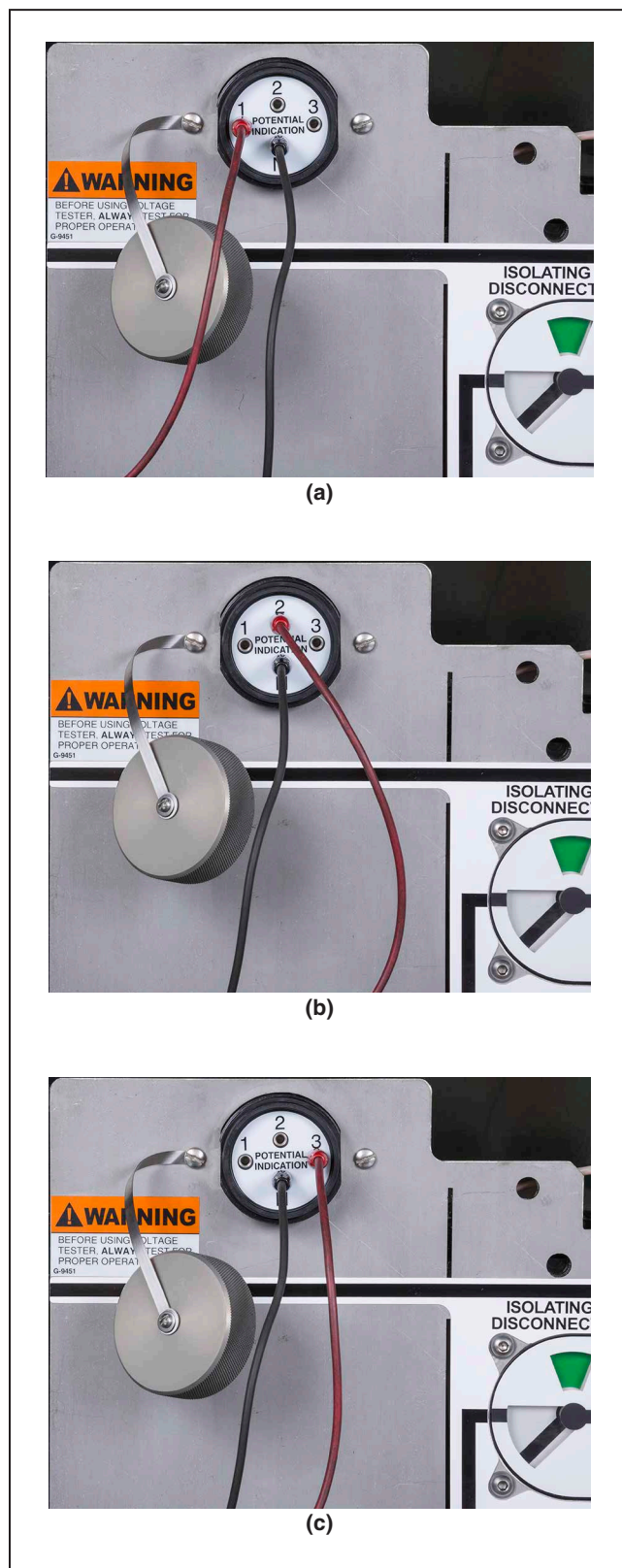


Figure 31. Measure the phase-to-neutral voltage of each phase of each way to be phased.

Operation

STEP 4. Determine the phase-to-phase relationships of the two ways to be phased as follows:

- (a) Remove the test probe of the voltmeter from the Neutral Jack.
- (b) Place one of the test probes on Test Jack 1 of the first way and place the other probe on Test Jack 1 of the second way. Measure the phase-to-phase voltage. When comparing the *same* phase of the two ways, the voltage should be 0.5 Vac or less for system voltages through 13.2 kV maximum, and between 0.5 Vac and 1.0 Vac for system voltages through 29 kV maximum, indicating the cables are in phase. See Figure 32(a).
- (c) Keep the test probe on Test Jack 1 of the first way and move the other test probe to Test Jack 2 of the second way. Measure the phase-to-phase voltage. When comparing *different* phases of the two ways, the voltage should be 1.7 to 2 times the phase-to-neutral voltage measured in Step 3. See Figure 32(b).
- (d) Keep the test probe on Test Jack 1 of the first way and move the other test probe to Test Jack 3 of the second way. Measure the phase-to-phase voltage. Again when comparing different phases of the two ways, the voltage should be 1.7 to 2 times the phase-to-neutral voltage measured in Step 3. See Figure 32(c).
- (e) Repeat Steps 4b through 4d for Test Jack 2 and Test Jack 3 of the first way.
- (f) If all the phase-to-phase relationships are correct, the cables are in phase and are properly installed.

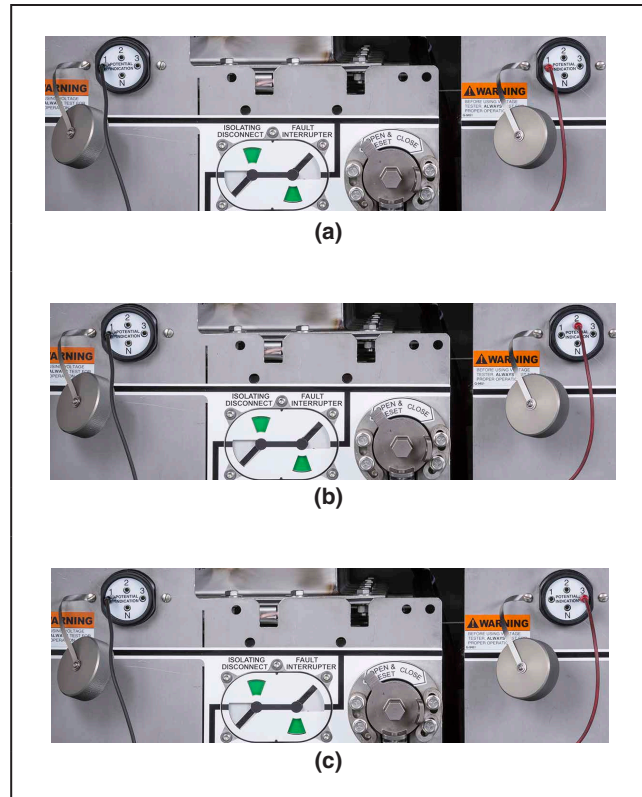


Figure 32. Measure the phase-to-phase relationships of the two ways to be phased. When comparing the same phase of the two ways, the voltage should be zero or close to zero, indicating the cables are in phase. When comparing different phases of the two ways, the voltage should be 1.7 to 2 times the phase-to-neutral voltage measured in Step 3.

Components

No mechanical maintenance is required for S&C Vista SD Underground Distribution Switchgear. However, occasional inspection and cleaning of the switchgear and exercising of the load-interrupter switches and fault interrupters is recommended. Refer to S&C Instruction Sheet 695-590, "S&C Vista® SD Underground Distribution Switchgear: *Inspection Recommendations.*"

DANGER

When access to the bushings on S&C Vista SD Underground Distribution Switchgear is required for inspection, service, or repairs, always observe the following precautions. Failure to observe these precautions will result in serious personal injury or death.

1. Access to the switchgear must be restricted only to qualified persons. See "Qualified Persons" on page 2.
2. Always follow safe operating procedures and rules.
3. Before touching any bushings, always disconnect the load-interrupter switches and fault interrupters from all power sources (including backfeed), test for voltage, and properly ground.
4. Always assume the bushings are energized unless proved otherwise by test or by visual evidence of an **Open-Circuit** condition at the isolating disconnect.
5. Test the bushings for voltage using the **Potential Indication** feature (if furnished) or other proper high-voltage test equipment.
6. After the switchgear has been completely disconnected from all sources of power and tested for voltage, ground all load-interrupter switches and fault interrupters.
7. Make sure the switchgear and pad-mounted enclosure (if furnished) are properly grounded to the station or facility ground. Do not return equipment to service unless such grounds are properly made.

Inspecting Cable Terminations

To visually inspect the cables or to measure the temperature of the cable terminations using a noncontact infrared thermometer without opening the termination compartment doors, lift the applicable termination compartment cover panel. See Figure 33.



Figure 33. Lift the cover panel to visually inspect the cables or to measure the temperature of the cable terminations.

Pad-Mounted Enclosure Finish

The responsibility for ensuring a finish protects the enclosure lies with both the manufacturer and the user. S&C Vista SD Underground Distribution Switchgear is finished with the S&C Ultradur® Finishing System, which provides lasting protection for the enclosure. To retain this protection, the user should take periodic corrective action as follows:

- STEP 1.** Touch up any penetration of the finish to bare metal, such as scratches and abrasions caused during shipping or by vandalism, to maintain the original integrity. S&C touch-up finish and primer are available in aerosol spray cans. Order catalog number 999-080 for light gray finish, 9999-058 for olive green finish, 9991363-493 for seafoam green, 9991363-488 for equipment green, and 9999-061 for red-oxide primer. See Figure 34. No other finish or primer is approved. The area to be touched up should be cleaned to remove oil and grease. Sand the area to remove any traces of rust that may be present, and make sure all edges are feathered before applying primer.
- STEP 2.** Provide an occasional simple washdown—similar to what would be given to an automobile—to remove surface contaminants. Use any ordinary mild household detergent solution.

In cases where the user must refinish the enclosure before the finish has weathered, such as when matching to other equipment, the user must take special precaution. The entire surface must be sanded to provide a tooth to bond the new coat to the unusually tough and smooth S&C Ultradur Finish.



Figure 34. Refinish any scratches or abrasions with S&C red-oxide primer and touch-up finish.

Replacing the Enclosure Latch Shear Pin

A shear pin is used at the mechanical joint between the pentahead (or hexhead when catalog number suffix “-H1” is specified) drive and the actuator of the enclosure latching mechanism. The shear pin prevents damage to the latching mechanism in the event excessive force (i.e. caused by vandalism, attempts to open the switchgear without removing the padlock, or use of a “breaker bar” or other torque-increasing device to turn the pentahead bolt) is used to attempt to open the latch. When excessive force is used, the shear pin will break to protect the latching mechanism from damage. See Figure 35.

How to tell if the shear pin is broken: A broken shear pin will render the latching system inoperable. When a pentahead socket wrench is used to turn the pentahead bolt, the pentahead socket wrench will rotate more than 360° counterclockwise without opening the latch.

The following procedure describes how to open the switchgear enclosure and replace the shear pin.

Tools Required:

- Needle-nose pliers
- Slotted (flathead) screwdriver

Parts Required:

- Shear pin (part number: CH-2902)
- Retaining ring (2 required) (part number: 1340-122)

STEP 1. Remove the padlock from the gear. If the shear pin was broken because someone tried to open the latch without first removing the padlock, turn the pentahead socket wrench clockwise to slowly “back off” the tension between the latching mechanism and the padlock, and then remove the padlock from the gear.

STEP 2. Use a pair of needle-nose pliers to remove the pentahead plug and shim washer from the latching mechanism. See Figure 36. If the actuator has been pushed backward while removing the pentahead plug, pull it forward to the fully closed position with a pair of needle-nose pliers. See Figure 37.

STEP 4. Using a long-handled screwdriver, insert the blade of the screwdriver into one of the pin holes inside the actuator. Brace the screwdriver against the rim of the socket. Using the screwdriver like a handle, turn the actuator 360° counterclockwise to unlock the hinged roof. See Figure 38. Lift the hinged roof to engage the “hold-open” latch for the roof.

STEP 5. Attach the shim washer and pentahead plug to the latching drive. Turn the pentahead plug until the holes in the plug align with the holes in the latching drive. See Figure 39.



Figure 35. Vista SD enclosure latch mechanism.

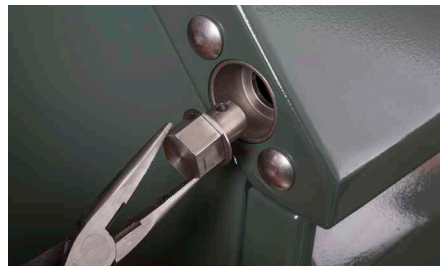


Figure 36. Remove the plug and shim washer.

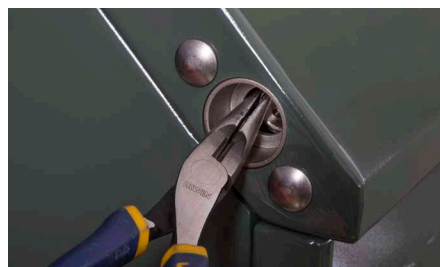


Figure 37. Pull the actuator forward if necessary.

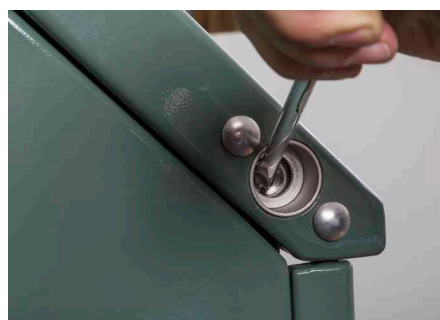


Figure 38. Rotate the actuator with a screwdriver until the latching mechanism opens.



Figure 39. Align hole in plug with the hole in the actuator.

- STEP 6.** Install one of the retaining rings on one end of the new shear pin. Insert the shear pin into the hole on the side of the latch drive. The pin should go completely through the latch drive and pentahead plug. See Figure 40.
- STEP 7.** Rotate the latch drive 180° and install the retaining ring on the opposite end of the shear pin. See Figure 41.
- STEP 8.** Insert a pentahead socket wrench or tool into the pentahead socket, and rotate it 360° counterclockwise. The mechanism should operate the latch smoothly through its full rotation and stop on reaching 360°.
- STEP 9.** Close and secure the hinged roof per the instructions in “Closing the Doors and the Hinged Roof” on Page 14.

Closing and Securing the Enclosure if Replacement Shear Pin is Unavailable

If the shear pin is broken and the enclosure needs to be opened for switching, and a replacement shear pin is unavailable, the enclosure can be easily closed and secured by following these steps:

- STEP 1.** Open the enclosure using the instructions described in “Replacing the Enclosure Latch Shear Pin” on page 23. Retain the pentahead plug and shim washer in a secure area. Perform any necessary switching.
- STEP 2.** Close the hinged roof of the switchgear.
- STEP 3.** Using a long-handled screwdriver, insert the blade of the screwdriver into one of the pin holes inside the actuator. Brace the screwdriver against the rim of the socket. Using the screwdriver like a handle, turn the screwdriver 360° clockwise to close and latch the hinged roof. See Figure 42.
- STEP 4.** Insert a padlock shackle through the hole in the padlock recess and lock the padlock. See Figure 43.



Figure 40. Install the new shear pin.



Figure 41. Install a retaining ring on the opposite side of the shear pin.

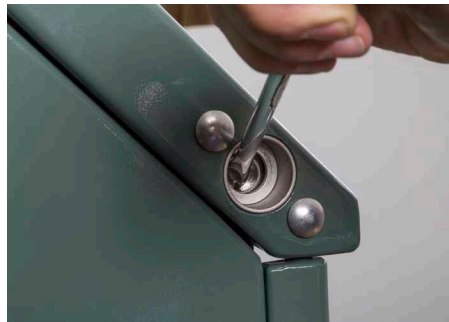


Figure 42. Rotate the actuator with a screwdriver until the latching mechanism closes.



Figure 43. Secure the enclosure with a padlock.

Routine Switchgear Testing

For the convenience of users who normally perform electrical tests on system components such as switchgear, appropriate withstand test values for Vista SD Underground Distribution Switchgear are given in Table 1 and Table 2 on page 26. These test values are significantly greater than the normal operating voltage of the switchgear and are near the flashover voltage of the switchgear. They should be applied only when the switchgear is completely de-energized and disconnected from all power sources.

WARNING

When performing electrical withstand tests on Vista SD Underground Distribution Switchgear, always observe the following precautions. **Failure to observe these precautions can result in a flashover, injury, and equipment damage.**

1. Completely de-energize the switchgear and disconnect it from all power sources.
2. Terminate the bushings with an insulated cap or other appropriate cable termination capable of withstanding the test voltage.

Table 1. Maximum Insulation Test Voltages

Vista SD Switchgear Rating, kV			Withstand Test Voltage, kV	
IEC	IEEE	Impulse (BIL)	Power Frequency ^①	Dc ^{②③}
12	17.5	95	31	42
24	29	125	45	62

① The power-frequency withstand test voltages listed in the table are approximately 80% of the design values for new equipment.

② The dc withstand test voltages listed in the table are approximately 80% of the design values for new equipment.

③ Dc withstand test voltages are given for reference for those users performing dc withstand tests. The presence of these values does not imply a dc withstand rating or performance requirements for the switchgear. A dc withstand design test is specified for new equipment because the switchgear may be subjected to dc test voltage when connected to the cable. The dc withstand test voltages listed in the table are approximately equal to the ac test voltage.

Dc Cable Testing and Fault Locating

Dc testing of installed cables is performed to determine the condition of the cables and to locate faults. Industry standards such as IEEE 400, "IEEE Guide for Making High-Direct-Voltage Tests on Power Cable Systems in the Field," describe such testing and should be referenced for selection of the test procedures. Dc testing also includes cable "thumping" (the sudden application of dc voltage from a large capacitor for the purpose of fault locating), which causes transients and voltage doubling at the end of the open cable. When the cables are attached to the switchgear, the unit will also be subjected to the dc test voltages.

WARNING

Aging, damage, or electrical or mechanical wear may reduce the dc withstand capability of the switchgear. Therefore, the dc test voltage must be selected such that it does not exceed the withstand limits of the switchgear. **Application of dc test voltage greater than the withstand capability of the switchgear can result in a flashover, injury, and equipment damage.**

DANGER

Do not exceed the test voltages given in Table 1. Exceeding the test voltages can cause a flashover of the isolating gap or phase-to-phase insulation of the switchgear. **This can lead to a power-frequency fault in the gear of the dc test source and result in severe personal injury or death.**

S&C Vista SD Underground Distribution Switchgear was designed to allow dc testing of the cables with the other ways of the gear energized. After testing, the dc test equipment should be used to discharge any stored charge on the cable. The dc test voltages and dc cable thumping voltages should not exceed the voltages given in Table 2.

⚠ WARNING

When testing cables connected to energized switchgear, proper isolation of the power-frequency source from the dc test source must be maintained. Follow the recommendations provided by the manufacturer of the dc test equipment or fault-locating equipment. Follow the user's operating and safety procedures for grounding the cable, connecting the dc test source, isolating the dc test source (in case of flashover), ungrounding the cable, applying the dc test source, discharging the cable, and regrounding the cable.

Table 2. Maximum Cable-Testing and Cable-Thumping Dc Withstand Voltages

Vista SD Switchgear Rating, kV			Dc Cable-Test Voltage, kV	Dc Cable-Thumping Voltage, kV ^①
IEC	IEEE	Impulse (BIL)		
12	17.5	95	34	17
24	29	125	40	20

① The dc cable-thumping voltage is 50% of the dc cable test voltage because voltage doubling will occur at the open end of the cable, which is assumed to be a unit of Vista SD Underground Distribution Switchgear. If the open end of the cable is grounded, the dc cable-thumping voltage applied to the cable and switchgear can be increased to the dc cable-test voltage.

Very Low Frequency (VLF) Cable Testing

IEEE Standard 400.2, "IEEE Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF) (less than 1 Hz)," addresses the application of 0.01- to 1-Hz high-voltage ac excitation as one means for evaluating a shielded power cable system during an acceptance test or a maintenance test. The cable system must be taken out of service for this testing.

An acceptance test is a field test made after installation of the power cable system, including terminations and joints, but before the cable system is placed in normal service. A maintenance test is a field test made during the operating life of a power cable system to detect deterioration and to check serviceability of the system.

VLF cable testing may subject the S&C Vista SD Underground Distribution Switchgear to the ac test voltage when the cables are attached to the switchgear. S&C recommends that the Vista SD Underground Distribution Switchgear be completely de-energized and disconnected from all power sources when performing VLF cable testing. However, Vista SD switchgear has been designed to allow VLF testing of the cables with the other ways of the gear energized, if necessary.

Upon completion of the VLF cable testing or an interruption in the testing, the test set must be turned off to discharge the cable circuit and test set. The cable system must then be grounded.

The VLF sinusoidal waveform test voltage applied to the S&C Vista SD Underground Distribution Switchgear must not exceed the voltages listed in Table 3 on page 27.

Table 3. Vista SD Switchgear Very Low Frequency (.01- to 1-Hz) Sinusoidal Waveform Maximum Test Voltages

Vista SD Switchgear System Class, kV	Acceptance Test (phase to ground)		Maintenance Test (phase to ground)	
	kV, RMS	kV, Peak	kV, RMS	kV, Peak
15.5	23	33	19	26
27	36	51	27	38

WARNING

Aging, damage, or electrical or mechanical wear may reduce the VLF ac withstand capacity of the switchgear. Therefore, the ac test voltage must be selected such that it does not exceed the withstand limits of the switchgear. **Application of ac test voltage greater than the withstand capability of the switchgear can result in a flashover, injury, and equipment damage.**

DANGER

Do not exceed the test voltages given in Table 3. Exceeding the test voltages can cause a flashover of the isolating gap or phase-to-phase insulation of the switchgear. **This can lead to a power-frequency fault in the gear or the VLF test source, and result in severe personal injury or death.**

WARNING

When testing cables connected to energized switchgear, proper isolation of the power-frequency source from the VLF test source must be maintained. Follow the recommendations provided by the manufacturer of the VLF test equipment. Follow the user's operating and safety procedures for grounding the cable, connecting the VLF test source, isolating the VLF test source (in case of flashover), ungrounding the cable, applying the VLF test source, discharging the cable, and regrounding the cable.

WARNING

When VLF cable testing has been completed or has been interrupted, you must discharge the cable system and the test equipment. Allow the time needed to fully discharge the cable system and test equipment. Failure to fully discharge the cable system and test equipment can result in serious damage to the cable system and test equipment.

Fault-Interrupter Testing

When performing dielectrical tests on Vista SD Underground Distribution Switchgear, the vacuum fault interrupters will not be subject to voltage across the open gap because the disconnect switch isolates the vacuum interrupters from the test voltage. Because the vacuum interrupter will not be energized across the open gap, there is no exposure to the X-rays normally associated with high-voltage testing of vacuum devices. Routine testing of the vacuum fault interrupters is not recommended. For those users who desire to test the vacuum interrupters, contact the nearest S&C Sales Office for specific instructions.

**Vista SD
Underground
Distribution
Switchgear Ratings**

Table 4. Vista SD Switchgear Ratings^①

System Class	Voltage, kV		Amperes, RMS	
	Max	BIL	Main Bus Continuous Current	Short-Circuit, RMS, Sym.
15 (12)	17.5 (12)	95 (75)	600 (630)	16 000★
27 (24)	29 (24)	125 (125)	600 (630)	12 500

① IEEE ratings are given first, with the IEC ratings in parentheses.

★ 12 500 amperes if fault interrupters are furnished with optional 200-ampere bushing wells in lieu of 600-ampere bushings.

**Ratings for S&C
Visi-Gap Load-
Interrupter Switches**

Complete ratings for Visi-Gap load-interrupter switches are shown in Table 5. Besides the load-dropping ratings shown, the switches are capable of interrupting transformer magnetizing currents associated with the applicable loads as well as line-charging and cable-charging currents typical for distribution systems of these voltage ratings. For applications involving load currents with high harmonic content (such as rectifier load currents), refer to the nearest S&C Sales Office. The duty-cycle fault-closing rating shown for the switch defines the ability to close the switch into the **Closed** position the designated number of times against a three-phase fault equal to the rated value, with the switch remaining operable and able to carry and interrupt rated current.

Table 5. Vista-Gap Load-Interrupter Switch Ratings

Applicable Standard	Freq., Hertz	Visi-Gap Load Interrupter Switches					
		Voltage, kV			Amperes		
		Nom.	Max	BIL	Continuous, Load Dropping, and Load Splitting ^①	Momentary and One-Second, Short-Time Withstand, RMS, Symmetrical	Three-Time Duty Cycle Fault Making, RMS, Symmetrical ^②
IEEE	60	15	17.5	95	600	16 000	16 000
		27	29	125	600	16 000	16 000
IEC	50	12	12	75	630	16 000	16 000
		24	24	125	630	16 000	16 000

① Parallel or loop switching.

② Applicable to fault closing into the **Closed** position.

**Ratings for S&C
Visi-Gap Fault
Interrupters**

Complete ratings for Visi-Gap fault interrupters are shown in Table 6. Besides the load-dropping ratings shown, the fault interrupters are capable of interrupting transformer magnetizing currents associated with the applicable load as well as line-charging and cable-charging currents typical for distribution systems of these voltage ratings.

Table 6. Visi-Gap Fault Interrupter Ratings

Applicable Standard	Freq., Hertz	Visi-Gap Fault Interrupters				
		Voltage, kV			Amperes	
		Nom.	Max	BIL	Continuous, Load Dropping, and Load Splitting ^①	Short-Circuit Interrupting, RMS, Symmetrical
IEEE	60	15	17.5	95	600	16 000★
		27	29	125	600	12 500
IEC	50	12	12	75	630	16 000★
		24	24	125	630	12 500

① 200 amperes if the fault interrupters are furnished with optional 200-ampere bushing wells.

★ 12 500 amperes if the fault interrupters are furnished with optional 200-ampere bushing wells in lieu of 600-ampere bushings.

Table 7. Switchgear Styles—Must be Specified

Item		Suffix to be Added to Switchgear Catalog Number	Applicable to Models	
Vault-mounted style. Where switchgear assembly is floor-mounted. Includes submersible wiring and control housing ^①	Vertical orientation, cables enter/exit from top, operating mechanism on bottom	Mild steel mounting stand	-V1	110, 101
			303, 312, 321, 330	
			404, 413, 422, 431, 440	
		505, 514, 523, 532, 541, 550		
		606, 615, 624, 633, 642, 651, 660		
		Stainless steel mounting stand	-V11	110, 101
	303, 312, 321, 330			
	404, 413, 422, 431, 440			
	505, 514, 523, 532, 541, 550			
	606, 615, 624, 633, 642, 651, 660			
	Vertical orientation, cables enter/exit from bottom, operating mechanism on top		Mild steel mounting stand	-V2
		303, 312, 321, 330		
404, 413, 422, 431, 440				
505, 514, 523, 532, 541, 550				
606, 615, 624, 633, 642, 651, 660				
Stainless steel mounting stand		-V12	110, 101	
	303, 312, 321, 330			
	404, 413, 422, 431, 440			
	505, 514, 523, 532, 541, 550			
	606, 615, 624, 633, 642, 651, 660			
	Horizontal orientation, cables enter/exit from sides	Mild steel mounting stand	-V3	110, 101
Stainless steel mounting stand		-V13	110, 101	
Pad-mounted-style. Includes pad-mounted style enclosure with olive green outdoor finish. Single-sided access facilitates installation adjacent to wall or other structure	Mild steel enclosure	-P1	210, 201	
			303, 312, 321, 330	
			404, 413, 422, 431, 440	
			505, 514, 523, 532, 541, 550	
	Stainless steel enclosure	-P11	606, 615, 624, 633, 642, 651, 660	
			210, 201	
			303, 312, 321, 330	
			404, 413, 422, 431, 440	
505, 514, 523, 532, 541, 550				
606, 615, 624, 633, 642, 651, 660				

^① For wall-mounted applications, refer to your nearest S&C Sales office.

Appendix D

Table 8. Optional Features

Item		Suffix to be Added to Switchgear Catalog Number	Applicable to Models	
Alternate-color outdoor finish ^①	Light gray	-A2	All	
	Equipment green	-A3		
	Seafoam green	-A4		
	Special color	-A5		
Hexhead Bolt in lieu of pentahead bolt ^①		-H1	All	
Base spacer with olive green outdoor finish, increases cable-termination height ^①	Mild steel	6 inches	-K7	210, 201
				303, 312, 321, 330
				404, 413, 422, 431, 440
				505, 514, 523, 532, 541, 550
				606, 615, 624, 633, 642, 651, 660
	Mild steel	12 inches	-K8	210, 201
				303, 312, 321, 330
				404, 413, 422, 431, 440
				505, 514, 523, 532, 541, 550
				606, 615, 624, 633, 642, 651, 660
	Stainless steel	6 inches	-K17	210, 201
				303, 312, 321, 330
				404, 413, 422, 431, 440
				505, 514, 523, 532, 541, 550
				606, 615, 624, 633, 642, 651, 660
	Stainless steel	12 inches	-K18	210, 201
303, 312, 321, 330				
404, 413, 422, 431, 440				
505, 514, 523, 532, 541, 550				
606, 615, 624, 633, 642, 651, 660				
Mounting provisions for fault indicator for each load-interrupter switch. Accommodates three-phase indicator with single-phase sensors ^①	Pad-mounted style enclosure with no viewing window in door	-F1	210, 312, 413, 514	
			321, 422, 523, 624	
			330, 431, 633	
			440	
			550	
	Pad-mounted style enclosure with viewing window in door	-F2	210, 312, 413, 514	
			321, 422, 523, 624	
			330, 431, 633	
			440	
			550	
			660	

^① Applicable to switchgear assemblies with a pad-mounted-style enclosure (catalog number suffix “-P1” or “-P11”).

Table 8. Optional Features—Continued

Item		Suffix to be Added to Switchgear Catalog Number	Applicable to Models
Parking stands	At all load-interrupter switches and bus taps	-G1	110▲, 312, 413, 514
			210, 321, 422, 523, 624
			330, 431, 532, 633
			440
			550
			660
	At all fault interrupters and bus taps	-G2	101▲, 321, 431
			201, 312, 422, 532, 642
			303, 413, 523, 633
			404, 514, 624
			505, 615
			606
Reverse color of the Open/Reset and Closed indicators (i.e., green for Closed and red for Open/Reset indicators)		-J1	All
Potential indication. Indicates presence of voltage on each phase. One indicator is provided for each load-interrupter switch and fault-interrupter way. Includes provisions for low-voltage phasing		-L2	110, 101, 210, 201 303, 312, 321, 330 404, 413, 422, 431, 440 505, 514, 523, 532, 541, 550 606, 615, 624, 633, 642, 651, 660
600-ampere bushing adapters <i>without</i> studs on all load-interrupter switches, fault interrupters and bus terminals (in lieu of 600-ampere bushing adapters <i>with</i> studs)		-M1	All
200-ampere bushing-well adapters on all fault interrupters and bus taps (in lieu of 600-ampere bushing adapters). Interrupting rating of fault interrupters is 12,500 amperes when 200-ampere bushing-well adapters are furnished		-M4	101●, 201★, 321, 431, 541, 651 312, 422 303, 413, 523, 633 404, 514, 624 505, 615 606
Continuous ground bus. Connects to all load-interrupter switches and fault interrupters; provides a convenient location to attach cable-concentric neutrals, separable connector drain wires, and user-provided grounding cables. Short-circuit rating of ground bus equals that of the switchgear assembly		-O	110, 101, 210, 201 303, 312, 321, 330 404, 413, 422, 431, 440 505, 514, 523, 532, 541, 550 606, 615, 624, 633, 642, 651, 660
Motor operator.①② Permits remote operation of the load-interrupter switch or fault interrupter. Includes a receptacle for a wired portable remote control pendant, plus a receptacle for auxiliary contacts to track the position of the isolating disconnect. Requires user-furnished 120–240-Vac, 50/60-Hz control power source	Way 1	-B1	All
	Way 2	-B2	
	Way 3	-B3	
	Way 4	-B4	
	Way 5	-B5	
	Way 6	-B6	
Auxiliary contacts for way <i>not</i> furnished with a motor operator.③ Track position of the isolating disconnect associated with each load-interrupter switch or fault interrupter	Way 1	-S1	All
	Way 2	-S2	
	Way 3	-S3	
	Way 4	-S4	
	Way 5	-S5	
	Way 6	-S6	

① Order portable remote control pendant, one per switchgear assembly; see Table 9 on page 33.

② For Models 210 and 201, specify motor operator on Way 1 only (catalog number suffix “-B1”).

③ For Models 210 and 201, specify auxiliary contacts on Way 1 only (catalog number suffix “-S1”).

▲ Parking stands will only be supplied on the entrance (center) set of bushings.

● 200-ampere bushing wells will be installed on lower bushings.

★ 200-ampere bushing wells will be installed on bus tap bushings.

TABLE CONTINUED ►

Appendix D

Table 8. Optional Features—Continued

Item		Suffix to be Added to Switchgear Catalog Number	Applicable to Models
Key interlock.① Locks the load-interrupter switch or fault interrupter in the Open position	Way 1	-X1	All
	Way 2	-X2	
	Way 3	-X3	
	Way 4	-X4	
	Way 5	-X5	
	Way 6	-X6	
External trip provisions.② Allow tripping of the fault interrupters using a trip signal from a remote location or an external relay. Requires a user-furnished 110–120-Vac, 50/60-Hz control power source	In addition to standard overcurrent control for all fault interrupters	-R31	101, 201, 321, 431, 541, 651
			312, 422, 532, 642
			303, 413, 523, 633
			404, 514, 624
			505, 615
			606
	In lieu of standard overcurrent control and current transformers for all fault interrupters	-R41	101, 201, 321, 431, 541, 651
			312, 422, 532, 642
			303, 413, 523, 633
			404, 514, 624
			505, 615
			606
External trip provisions.② Allow tripping of the fault interrupters using a trip signal from a remote location or an external relay. Requires a user-furnished 220–240-Vac, 50/60-Hz control power source	In addition to standard overcurrent control for all fault interrupters	-R33	101, 201, 321, 431, 541, 651
			312, 422, 532, 642
			303, 413, 523, 633
			404, 514, 624
			505, 615
			606
	In lieu of standard overcurrent control and current transformers for all fault interrupters	-R43	101, 201, 321, 431, 541, 651
			312, 422, 532, 642
			303, 413, 523, 633
			404, 514, 624
			505, 615
			606
Alternate-language labels	Spanish	-L51	All
	Portuguese	-L52	
	French	-L53	
	Chinese	-L54	
	Arabic	-L55	
International crating. Wood products used in packaging are hardwood or certified by the supplier to be “heat-treated” (kiln-dried) to a core temperature of 133°F (56°C) for a minimum of 30 minutes		-L71	110, 101
			210, 201
			303, 312, 321, 330
			404, 413, 422, 431, 440
			505, 514, 523, 532, 541, 550
			606, 615, 624, 633, 642, 651, 660

① For Models 210 and 201, specify key interlock on Way 1 only (catalog number suffix “-X1”).

② The user-furnished trip-initiating signal must be a momentary contact. For applications requiring the use of a latching contact, refer to the nearest S&C Sales Office for assistance.

Table 9. Accessories

Item		Catalog Number	
Shotgun clamp stick—for use with separable connectors	6-foot-5½-inch length	9933-150	
	8-foot-½-inch length	9933-151	
Storage bag for shotgun clamp stick. Heavy canvas	6-foot-6-inch length	9933-152	
	8-foot-6-inch length	9933-153	
Pentahead socket for ½-inch drive		9931-074	
Motor operator.①② Facilitates power operation of load-interrupter switches or fault interrupters. Can be permanently attached to load-interrupter switches or fault interrupters, or it can be used as a portable motor operator to effect operation of a load-interrupter switch or fault interrupter from a remote location. Requires user-furnished 120–240-Vac, 50/60-Hz control power source		38415-A	
Portable remote control pendant with a 25-foot (762-cm) cable.③ Includes OPEN/RESET, CLOSE, and ENABLE pushbuttons, operator- and isolating-disconnect position-indicating lamps, and a lamp test button. The pendant is fully submersible		TA-3273-25	
Portable remote control pendant with a 50-foot (1524 cm) cable.③ Includes OPEN/RESET, CLOSE, and ENABLE pushbuttons, operator- and isolating-disconnect position-indicating lamps, and a lamp test button. The pendant is fully submersible		TA-3273-50	
Overcurrent control adapter cable. Required for programming overcurrent control	For connecting a control to a user-furnished personal computer in the field	For personal computers having a 25-pin serial communication port	TA-2366
		For personal computers having a 9-pin serial communication port	TA-2367
	For connecting a control to user-furnished personal computer in the shop	For personal computers having a 25-pin serial communication port	TA-2368
		For personal computers having a 9-pin serial communication port	TA-2369

① Order portable remote control pendant, one per switchgear assembly or one for each portable motor operator.

② If switchgear is furnished with optional auxiliary contacts (catalog number suffix “-S1” through “-S6”), the portable remote control pendant will show the position of the load-interrupter switch or fault interrupter *and* the position of the isolating disconnect.

③ The default color scheme for operator and isolating disconnect position-indicating lamps is green for OPEN/RESET and red for CLOSED indicators (these can be reversed).

Appendix F

Table 10. Replacement Parts

Item	Catalog Number
600-ampere bushing adapter kit	CHA-1976
200-ampere bushing-well adapter kit	CHA-1975
Bushing and bushing-well adapter assembly tool①	CH-2728

① The tool *can* be used to remove/install 600-ampere bushing adapters; it *must* be used to remove/install 200-ampere bushing-well adapters.

Table 11. USB Cable Kit

Item	Catalog Number
USB cable kit for connecting a personal computer to overcurrent control. Includes driver CD-ROM and installation instructions	TA-3153

Appendix G

Table 12. Touch-Up Kit Components—Aerosol coatings in 9-ounce cans

Item	Catalog Number
S&C light gray outdoor finish	9999-080
S&C olive green outdoor finish	9999-058
S&C seafoam green outdoor finish	9991363-493
S&C equipment green outdoor finish	9991363-488
S&C red-oxide primer	9999-061

Appendix H

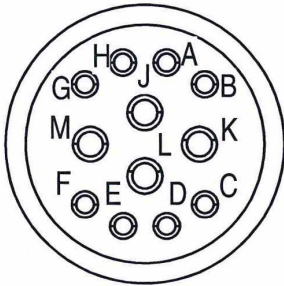


Table 13. Auxiliary Contacts Receptacle Connector

Pin #	Function
A	n/c
B	Vacuum interrupter closed (NO)
C	Vacuum interrupter closed (NC)
D	Vacuum interrupter open (NO)
E	Vacuum interrupter open (NC)
F	Isolating disconnect closed (NO)
G	Isolating disconnect closed (NC)
H	Isolating disconnect open (NO)
J	Isolating disconnect open (NC)
K	Common
L	Shield
M	n/c

Legend: n/c = no connection

