Operation

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June 2, 2025

Qualified Persons

⚠ WARNING

Only qualified persons knowledgeable in the installation, operation, and maintenance of overhead and underground electric distribution equipment, along with all associated hazards, may install, operate, and maintain the equipment covered by this publication. A qualified person is someone 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 special precautionary techniques, personal protective equipment, insulated 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

Thoroughly and carefully read this instruction sheet and all materials included in the product's instruction handbook before installing or operating the Vista SD Underground Distribution Switchgear. Become familiar with the Safety Information on pages 4 through 5 and Safety Precautions on page 6. The latest version of this publication is available online in PDF format at **sandc.com/en/contact-us/product-literature/**.

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 695-540, "S&C Vista SD Underground Distribution Switchgear PMH and PME Configurations: *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 S&C Specification Bulletin 695-33 for descriptions of optional features.

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. Ratings for the Vista SD Underground Distribution Switchgear are listed in the ratings table in Specification Bulletin 695-33. The ratings are also on the nameplate affixed to the product.

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels and tags attached to the product. Become familiar with these types of messages and the importance of these 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 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 any portion of this instruction sheet is unclear and assistance is needed, contact the 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

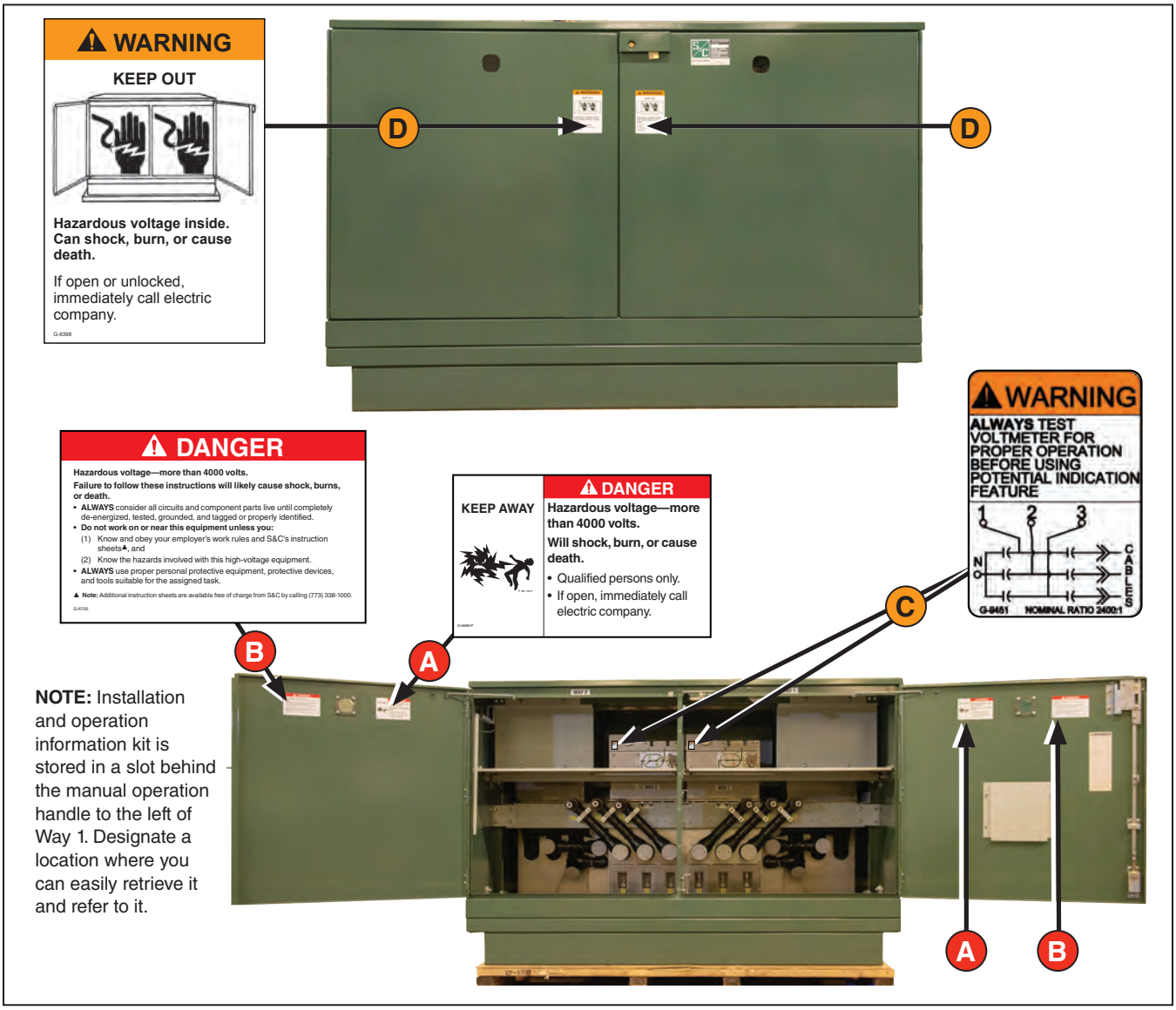
Read this instruction sheet thoroughly and carefully before operating the Vista SD Underground Distribution Switchgear.

Replacement Instructions and Labels

If additional copies of this instruction sheet are required, contact the 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 the nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

Location of Safety Labels



NOTE: Installation and operation information kit is stored in a slot behind the manual operation handle to the left of Way 1. Designate a location where you can easily retrieve it and refer to it.

Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Part 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	Voltage Tester–Always Test for Proper Operation . . .	G-9451
D	⚠ WARNING	Keep Out–Hazardous Voltage Inside	G-6398

⚠ DANGER

Vista SD Underground Distribution Switchgear operate at high voltage. Failure to observe the precautions below 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. **SAFETY LABELS.** Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "*NOTICE*" labels.
5. **ACCESS CONTROL.** 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.
6. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.
7. **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.
8. **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.
9. **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.
10. **BACKFEED.** Bushings, cables, load-interrupter switches, and fault interrupters may be energized by backfeed.
11. **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.
12. **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.

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 27 kV and 16 kA symmetrical interrupting.

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 15 kV and through 12.5 kA symmetrical at 27 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. 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 or elbow-connected voltage transformers (VTs) for self-powered operation. Motor operators are either controlled from a hand-held, cable-connected portable remote control pendant or via pushbutton controls in a low-voltage enclosure.

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 a USB cable. The control features a variety of fuse and relay time-current characteristic (TCC) curves that comply with IEEE Standard C37.112.

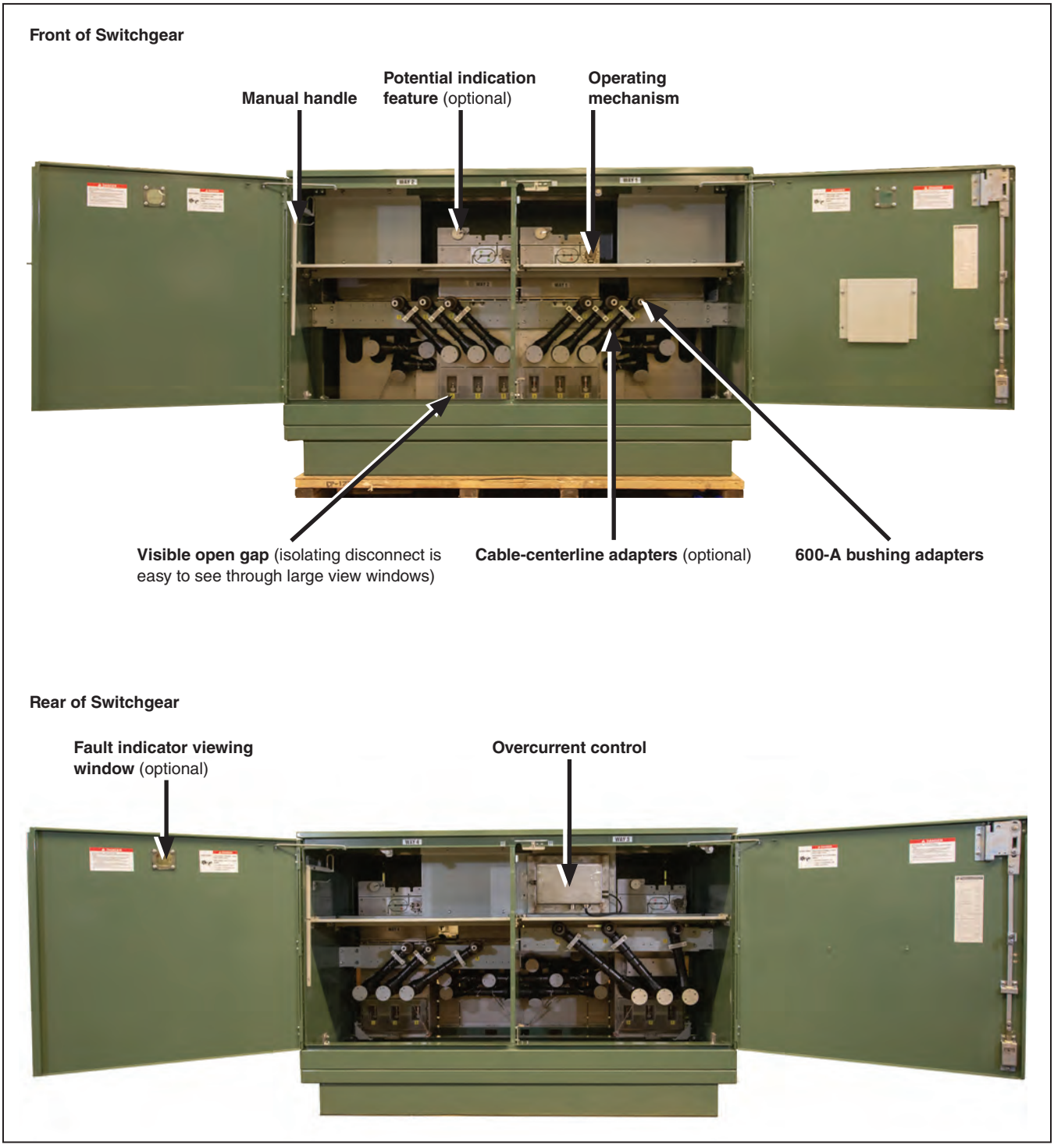


Figure 1. A PME configuration model 431 (4-way) Vista SD switchgear (catalog number suffix "-E11").

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."

To access the interior of the switchgear and operate the Visi-Gap load-interrupter switches or Visi-Gap fault interrupters, complete the following steps:

STEP 1. To access one side of the gear, remove the padlock from the gear.

STEP 2. Insert a pentahead socket wrench or tool (a hex-head socket wrench or tool when catalog number suffix "-N" is specified) into the latching mechanism. Rotate the wrench or tool 60° counterclockwise to unlatch the doors. See Figure 2.

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.

STEP 3. Open the right door fully and latch the door holder. See Figure 3.

STEP 4. To open the left door, turn up the door latching mechanism, then swing the left door open fully and latch the door holder. See Figure 4 on page 10)

STEP 5. To open the other side of the gear, repeat Step 1 through Step 4.

Figure 2. To unlock the front doors, turn the pentahead socket wrench 60° counterclockwise against spring resistance until a "click" is heard and the wrench reaches its stop.

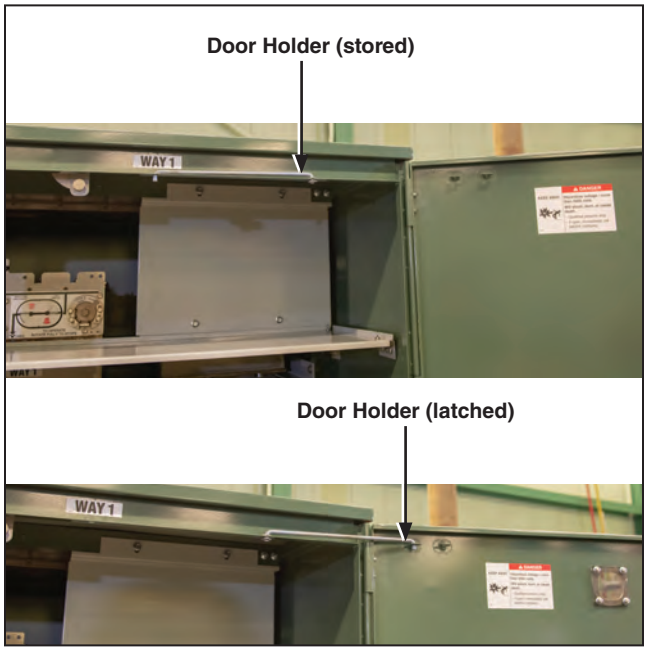


Figure 3. Using the door holder to hold the door open.

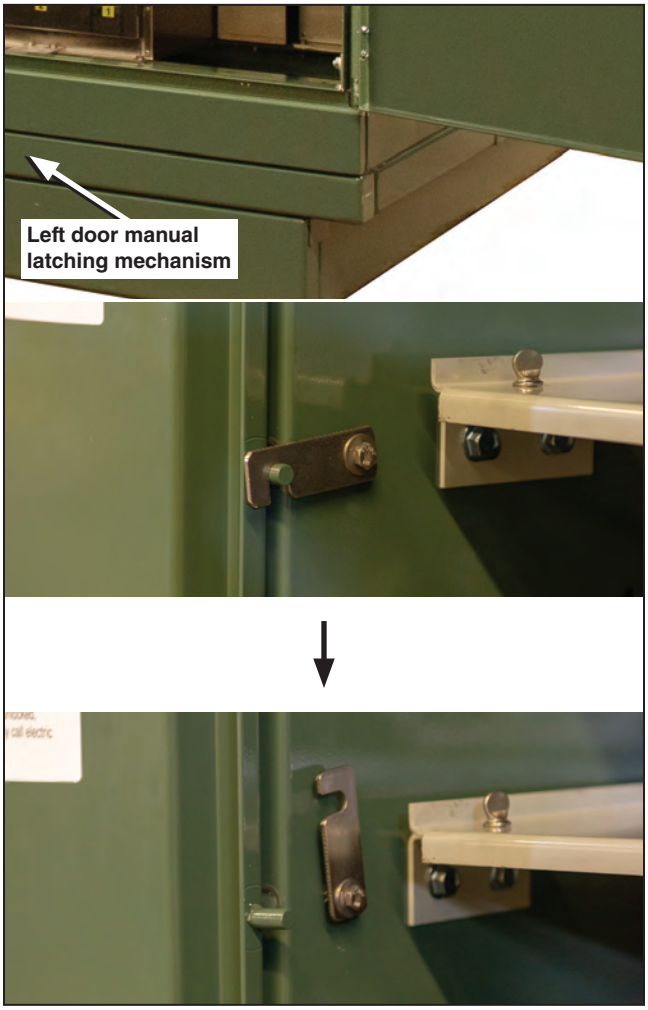


Figure 4. Disengaging the left door manual latching mechanism.

STEP 6. Retrieve the manual operating handle from its storage location at the top-left side of the switchgear assembly. See Figure 5.

STEP 7. Pull the knob forward at the top of the enclosure entryway to move the manual operating guide ring to the active **Down** position. See Figure 6(a) and 6(b). Insert the manual operating handle through the guide ring; attach the handle to the shaft of the operating mechanism. See Figure 6(c), and 6(d).

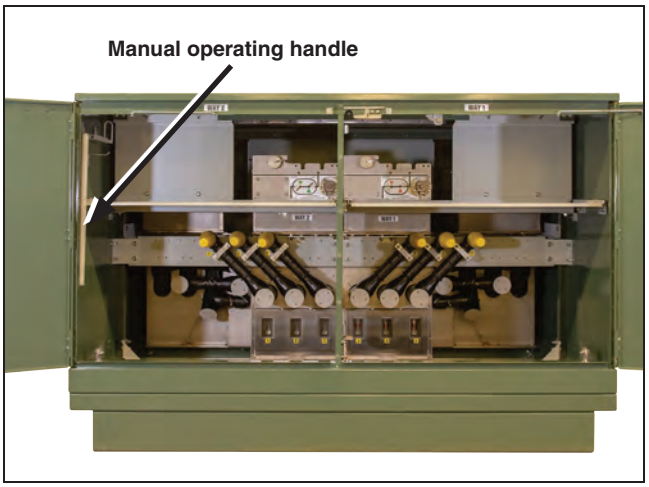


Figure 5. Storage location of the manual operating handle.

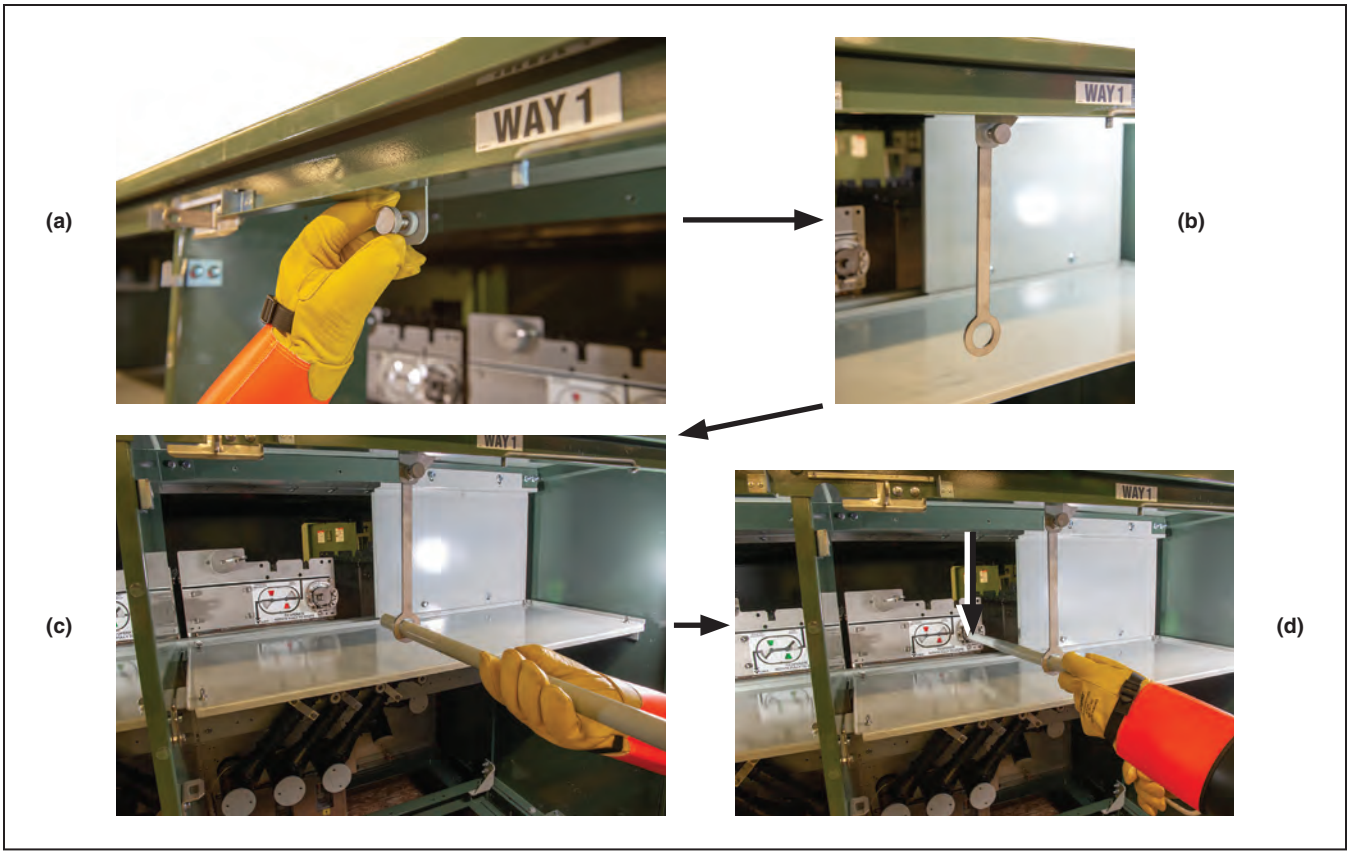


Figure 6. Pull the operating handle guide ring knob forward to move the guide ring into the active Down position (a and b); insert the handle through the guide ring and attach it to the shaft of the operating mechanism (c) and (d).

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 7.

(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).

STEP 9. Check the POSITION indicators to confirm the load-interrupter switch or fault interrupter has been operated successfully. See Figure 8

STEP 10. Confirm the position of the isolating disconnect using the large viewing window. See Figure 9.

STEP 11. Return the manual handle to its storage location, taking care to position the tether out of the way.

STEP 12. Pull the knob forward at the top of the enclosure entry way and move the manual operating guide ring to the inactive **Up** position.

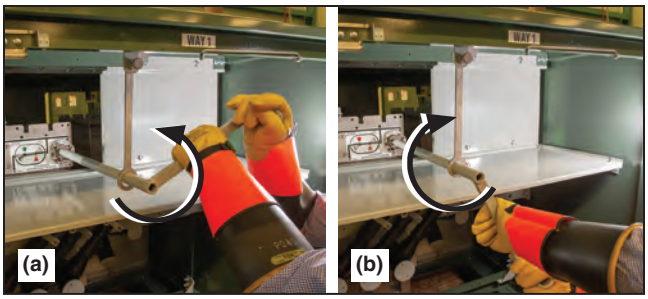


Figure 7. Rotate the operating handle counterclockwise to open (a), clockwise to close (b).

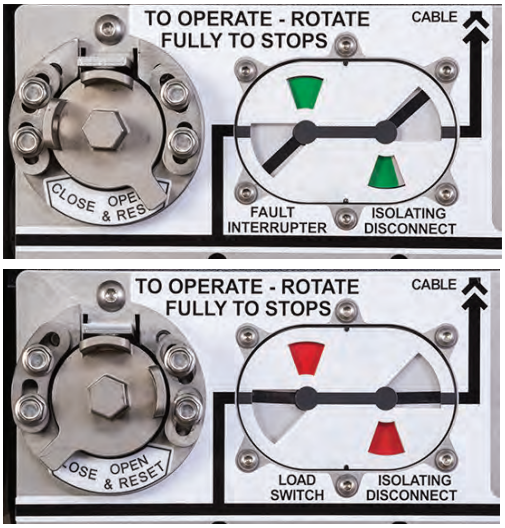


Figure 8. Indicators and mimic bus show the position of the load-interrupter switch or fault interrupter.

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

Resetting Visi-Gap Fault Interrupters

To reset the Visi-Gap Fault Interrupters after a fault has occurred, complete the following steps:

STEP 1. Check the POSITION indicators to confirm the fault interrupter has tripped. After a fault has occurred the fault interrupter will be in the **Open** position and the isolating disconnect will be in the **Closed** position. See Figure 10.

STEP 2. Retrieve the manual operating handle from its storage location.

STEP 3. Pull the knob forward at the top of the enclosure entryway to move the manual operating guide ring to the active **Down** position. See Figure 11 (a) and (b). Insert the manual operating handle through the guide ring; attach the handle to the shaft of the operating mechanism. See Figure 11 (c), and (d).

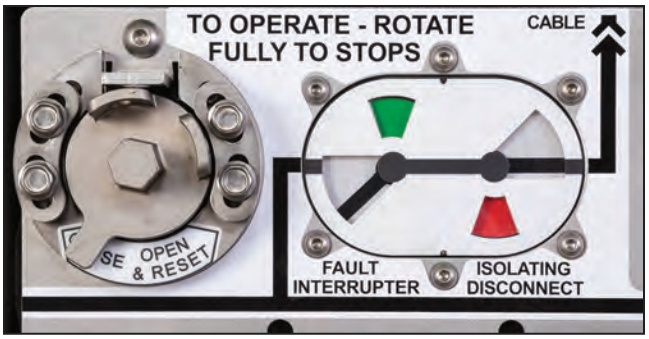


Figure 10. The POSITION indicator after a fault has occurred. The fault interrupter is open, and the isolating disconnect is closed.

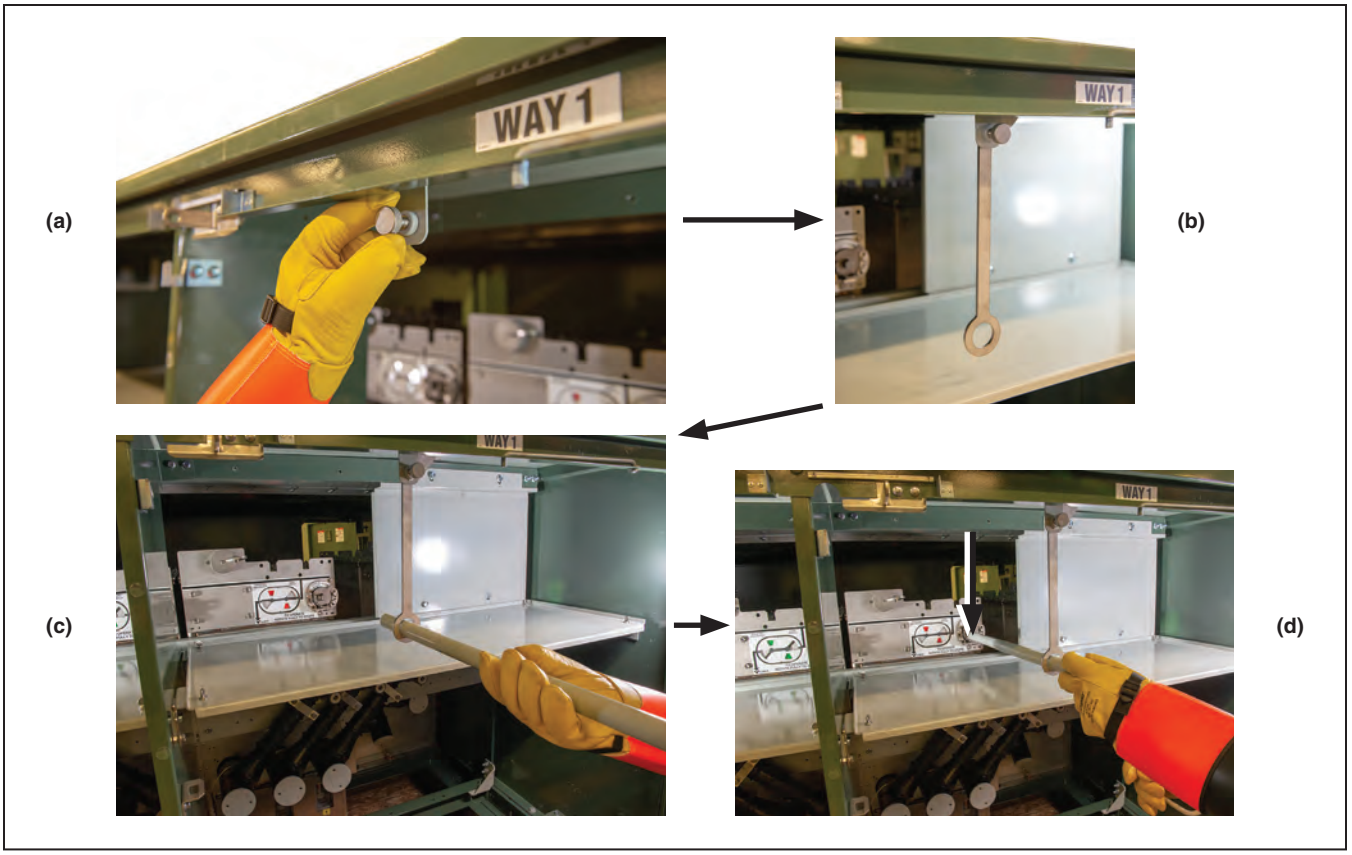


Figure 11. Pull the operating handle guide ring knob forward to move the guide ring into the active Down position (a and b); insert the handle through the guide ring and attach it to the shaft of the operating mechanism (c) and (d).

STEP 4. Rotate the handle counterclockwise firmly, and without hesitation, all the way to the stops to reset the fault interrupter. See Figure 12.

STEP 5. Check the POSITION indicators to confirm the fault interrupter has been opened. See Figure 13.

STEP 6. Confirm the position of the isolating disconnect using the large viewing window. See Figure 14.

STEP 7. Return the manual operating handle to its storage location, taking care to position the tether out of the way of the roof latch and roof hinge.

STEP 8. Pull the knob forward at the top of the enclosure entry way and move the manual operating guide ring to the inactive **Up** position.

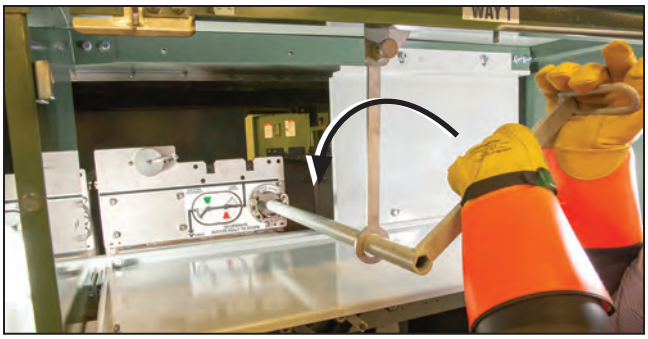


Figure 12. Resetting the fault interrupter after a fault.

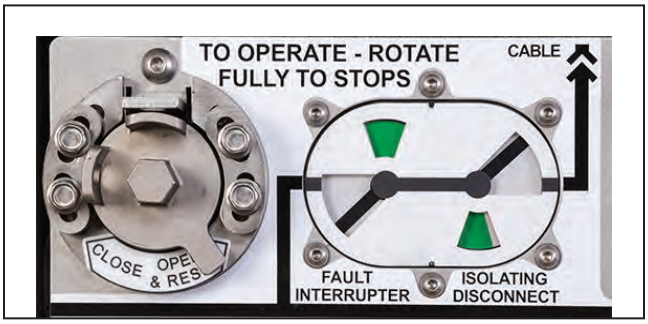


Figure 13. The POSITION indicator after the fault interrupter has been opened and reset.

Figure 14. The isolating disconnect after the fault interrupter has been opened and reset.

To re-energize the circuit:

STEP 1. Retrieve the manual operating handle from its storage location.

STEP 2. Pull the knob forward at the top of the enclosure entryway to move the manual operating guide ring to the active **Down** position. See Figure 11 (a) and (b) on page 13. Insert the manual operating handle through the guide ring; attach the handle to the shaft of the operating mechanism. See Figure 11 (c), and (d) on page 13.

STEP 3. Rotate the manual operating handle clockwise to close the fault interrupter. See Figure 15.

STEP 4. Check the POSITION indicators to confirm the fault interrupter is closed. See Figure 16.

STEP 5. Confirm the position of the isolating disconnect using the large viewing window. See Figure 17.

STEP 6. Return the manual operating handle to its storage location, taking care to position the tether out of the way of the roof latch and roof hinge.

STEP 7. Pull the knob forward at the top of the enclosure entry way and move the manual operating guide ring to the inactive **Up** position.

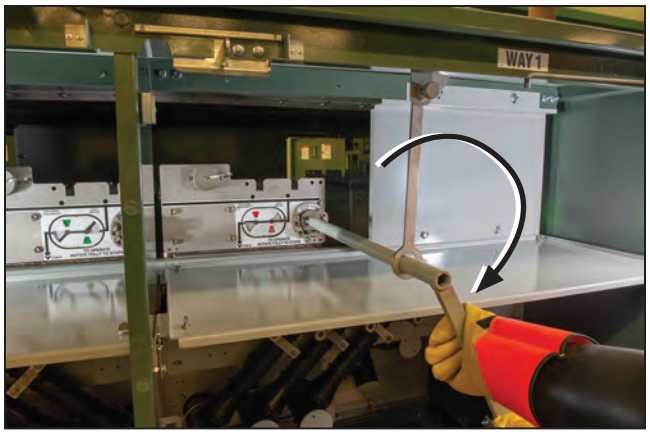


Figure 15. Closing the fault interrupter.

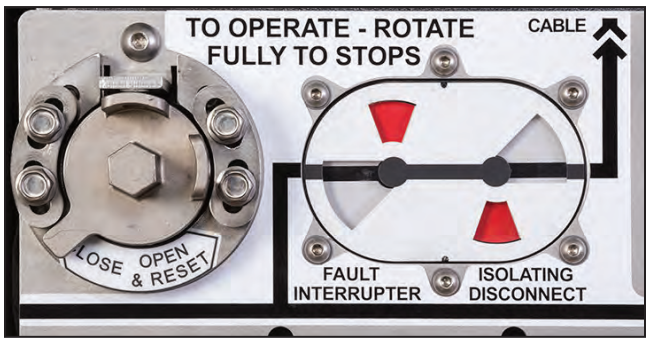


Figure 16. The POSITION indicator after the fault interrupter has been closed.

Figure 17. The isolating disconnect after the fault interrupter has been closed.

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 18.

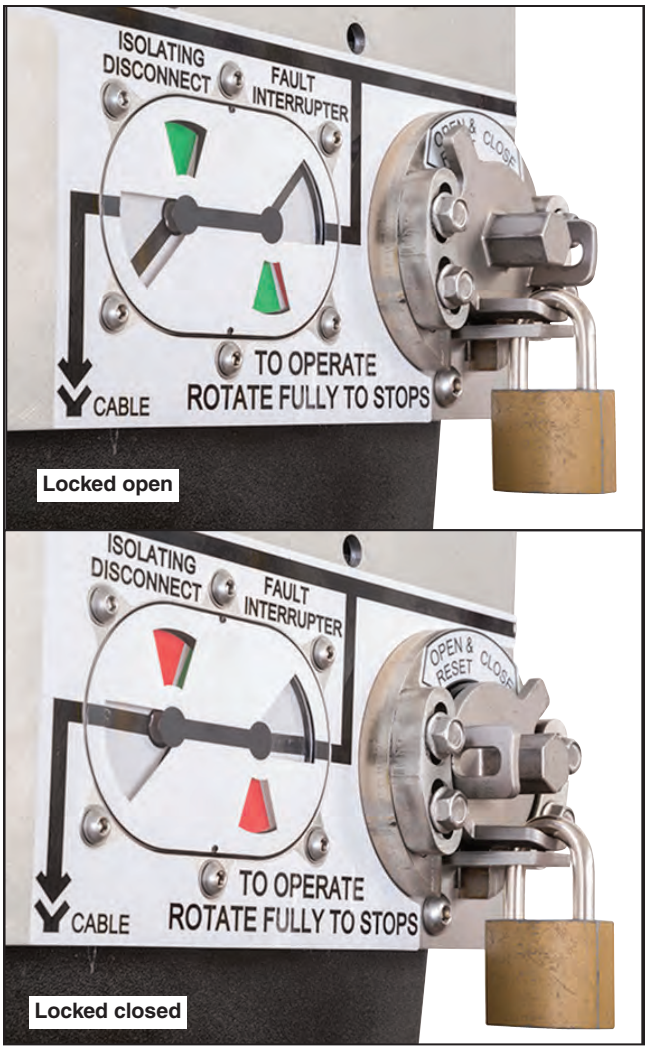


Figure 18. The load-interrupter switches or fault interrupters may be padlocked in either position.

Checking for Voltage Using the Optional Potential Indication Feature

NOTICE

Petroleum-based solvents should not be used on or around Vista SD Underground Distribution Switchgear.

STEP 1. Using water and mild soap, if necessary, clean the surface of the operating mechanism front panel around the **Potential Indication** feature.

STEP 2. Unscrew the aluminum cap covering the **Potential Indication** feature. See Figure 19.

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 20. 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 there may be a poor connection, or the **Potential Indication** feature or the voltmeter may not be operating properly. Check all voltmeter and lead connections and retest. If there is still no reading on the meter, check for voltage using an alternate method.

Note: 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%.

Figure 19. The Potential Indication feature with the cover removed.

Figure 20. Checking for voltage using a voltmeter.

Low-Voltage Phasing Using Optional Potential-Indication Feature

NOTICE

Petroleum-based solvents should not be used on or around Vista SD Underground Distribution Switchgear.

STEP 1. Using water and mild soap, if necessary, clean the surface of the operating mechanism front panel around the **Potential Indication** feature.

STEP 2. Unscrew the aluminum cap covering the **Potential 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:

(a) Set the voltmeter for volts ac.

(b) Connect one of the test probes of the voltmeter to the neutral jack of the way to be phased.

(c) 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 21 (a), (b), and (c).

(d) If the voltage measured at each test jack is greater than 0.5 Vac and they are equal, proceed to Step 4 on page 19.

(e) 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, there may be a poor connection or the voltmeter may not be operating properly. Check all voltmeter and lead connections and retest. If the voltages measured are still not equal, phasing should be performed using an alternate method.

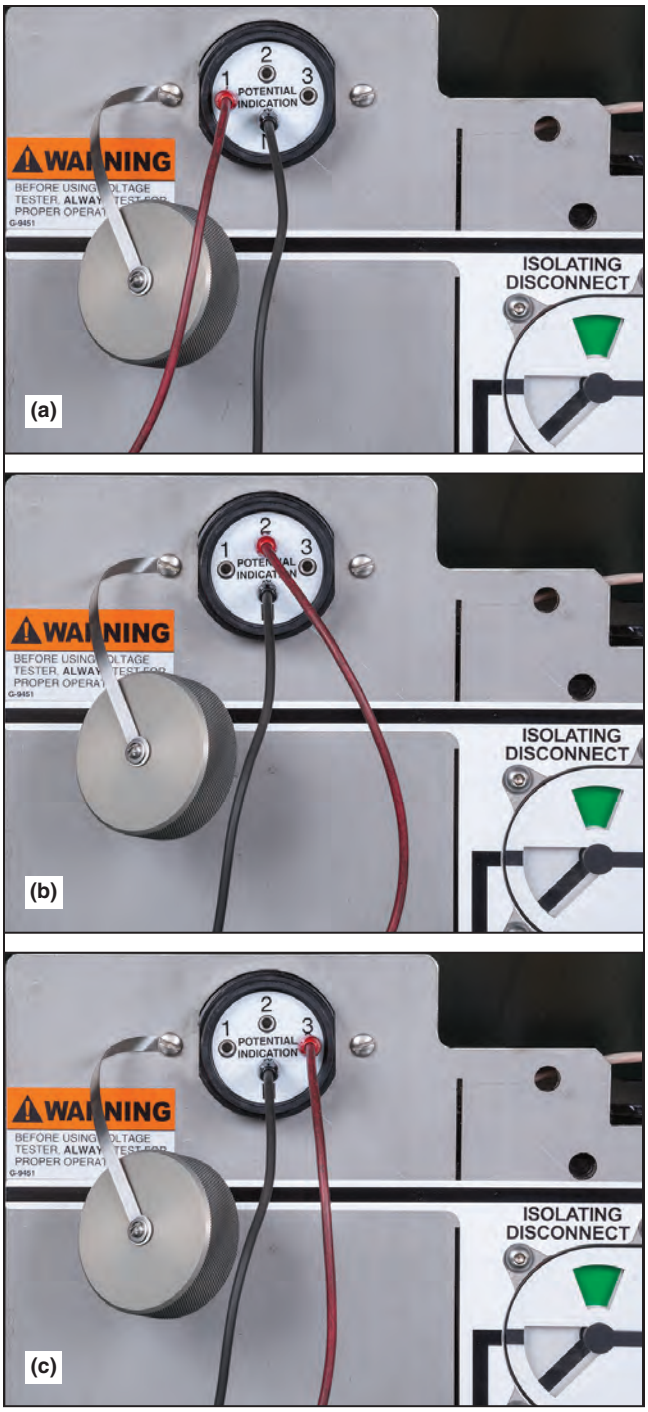


Figure 21. Measure the phase-to-neutral voltage of each phase of each way to be phased.

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 22 (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 on page 18. See Figure 22 (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 on page 18. See Figure 22 (c).

(e) Repeat Step 4b through Step 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.

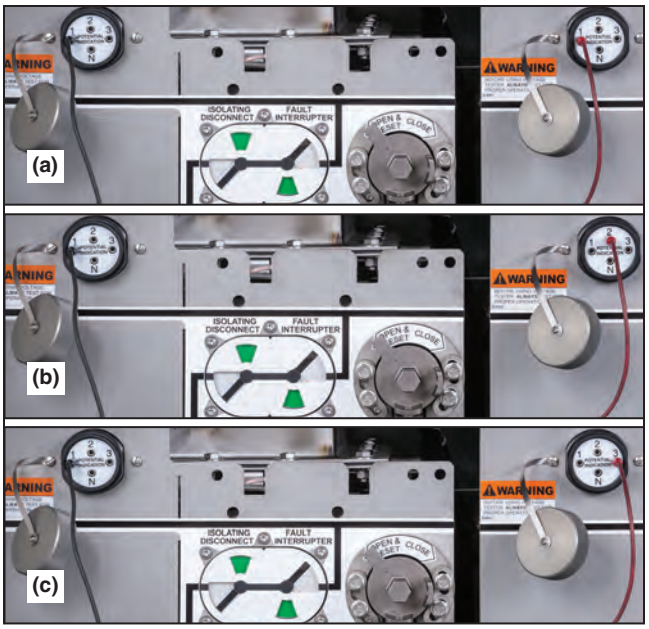


Figure 22. Measure the phase-to-phase relationships of the two ways to be phased. When comparing the same phase of the two ways, the voltage should be zero or close to zero, indicating the cables are in phase. When comparing different phases of the two ways, the voltage should be 1.7 to 2 times the phase-to-neutral voltage measured in Step 3 on page 18.

Closing the Doors

STEP 1. Lift the door holder up to allow the door to swing closed. See Figure 23. Make sure the door holder is placed back in the storage position to allow the door to be fully closed. See Figure 24.

STEP 2. Close the left-hand door and engage the left-door latching mechanism. See Figure 25.

STEP 3. Repeat Step 1 for the right door.

STEP 4. The right-hand door of the unit is equipped with the Penta-Latch® Mechanism which latches automatically when the door is closed. To close a door equipped with the Penta-Latch Mechanism, place one hand at the midpoint of the door-front near the edge and firmly push the door closed. When the latch points are positively engaged, the spring mechanism will trip to latch the door.

STEP 5. Insert the padlock shackle through the hole in the padlock recess and lock the padlock. See Figure 26.

STEP 6. Repeat Step 1 through Step 5 for the doors on the other side of the enclosure (if open).

Figure 23. Lift the door holder to allow the door to swing closed.

Figure 24. Door holder placed in the storage position to allow the door to close.

Figure 25. Left door latching mechanism engaged.

Figure 26. Enclosure doors padlocked.

Inspection Recommendations

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.

- Access to the switchgear must be restricted only to qualified persons. See "Qualified Persons" on page 2.
- Always follow safe operating procedures and rules.
- 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.
- Always assume the bushings are energized unless proved otherwise by test or by visual evidence of an **Open-Circuit** condition at the isolating disconnect.
- Test the bushings for voltage using the **Potential Indication** feature (if furnished) or other proper high-voltage test equipment.
- After the switchgear has been completely disconnected from all sources of power and tested for voltage, ground all load-interrupter switches and fault interrupters.
- 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

Cable terminations can be inspected visually or by using a noncontact infrared thermometer to check temperature. To remove cables or cable accessories, the enclosure shelf will need to be removed. This can be done by clearing the shelf of any items and unscrewing the hand bolts at the four corners of the shelf. See Figure 27.

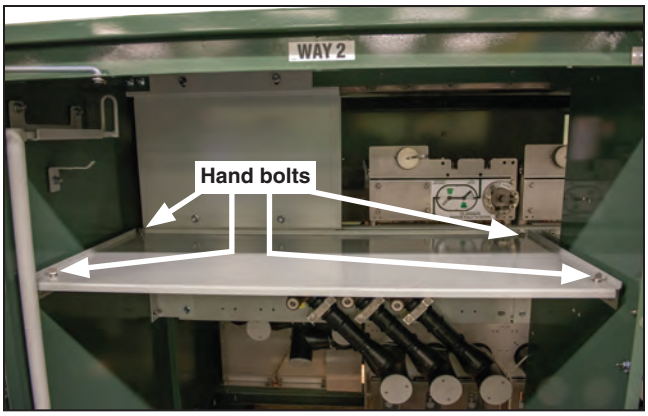


Figure 27. Location of the hand bolts on the shelf for shelf removal (if necessary).

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® II Outdoor Finish, which provides lasting protection for the enclosure. To retain this protection, the user should take periodic corrective action as follows:

STEP 1. Refinish any scratches or abrasions with S&C touch-up finish and red-oxide primer which are available in aerosol spray cans. See Figure 28. See S&C Specification Bulletin 695-33 for catalog number information used for ordering. 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 II Outdoor Finish.

Figure 28. Refinish any scratches or abrasions with S&C red-oxide primer and touch-up finish.

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 25. 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 Frequency①	Dc②③
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

The dc withstand capability of the switchgear may be reduced because of aging, damage, or electrical or mechanical wear. 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 or Table 2 on page 25. 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 of death.**

S&C Vista SD Underground Distribution Switchgear allows 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 on page 25.

⚠ WARNING

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, kV①
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

⚠ WARNING

The dc withstand capability of the switchgear may be reduced because of aging, damage, or electrical or mechanical wear. 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 will lead to a power-frequency fault in the gear or the VLF test source, and result in severe personal injury or death.**

⚠ WARNING

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. **Failure to follow these operating and safety procedures can result in injury or equipment damage.**

⚠ WARNING

When VLF cable testing has been completed or has been interrupted, the user must discharge the cable system and the test equipment. Allow the time needed to fully discharge 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.**

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.

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

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.

Table 4. 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	

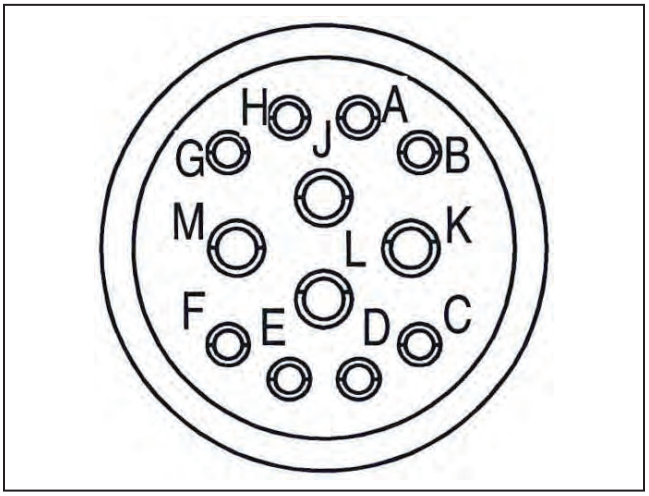


Figure 29. Auxiliary contacts receptacle connector pin locations.