

# Operation



This green leaf icon designates information specifically for Vista Green Underground Distribution Switchgear that uses an eco-friendly insulating gas. Unless otherwise designated, instructions provided apply to all manual Vista switchgear products.

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## Introduction

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### Qualified Persons

#### **WARNING**

Only qualified persons who are knowledgeable in the installation, operation, and maintenance of 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 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 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 before installing or operating Vista Underground Distribution Switchgear. Familiarize yourself with the Safety Information and Safety Precautions on pages 4 through 6. The latest version of this publication is available online in PDF format at [sandc.com/en/support/product-literature/](http://sandc.com/en/support/product-literature/).

### Retain this Instruction Sheet

This instruction sheet is a permanent part of Vista 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. Ratings for this gear are listed on a ratings label at the front of the switchgear. See S&C Specification Bulletin 681-31 for more information.

### Warranty

The warranty and/or obligations described in S&C's Price Sheet 150, "Standard Conditions of Sale-Immediate Purchasers in the United States," (or Price Sheet 153, "Standard Conditions of Sale-Immediate Purchasers Outside the United States"), 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 the seller's entire 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 (or Price Sheet 153), 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 (OR PRICE SHEET 153) 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 (or PRICE SHEET 153).

## Safety Information

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### Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels attached to the Vista 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 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](http://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 installing or operating your Vista switchgear.

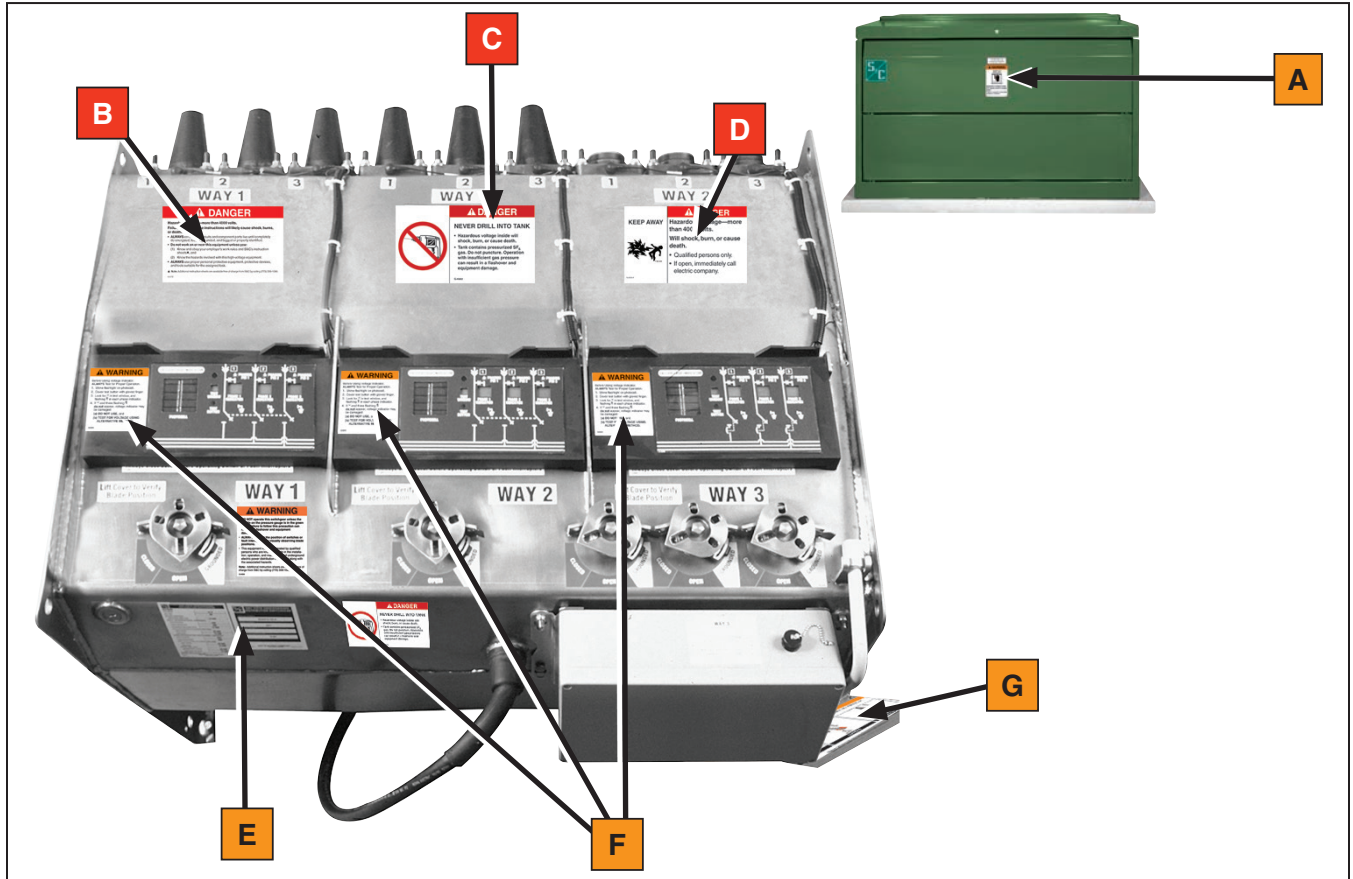


### Replacement Instructions and Labels

If additional copies of this instruction sheet are needed, 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



Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Part Number
A	<b>⚠ WARNING</b>	Keep Out—Hazardous Voltage Inside	G-6681
B	<b>⚠ DANGER</b>	Hazardous Voltage—Always Consider Circuits and Components Live . . .	G-6700
C	<b>⚠ DANGER</b>	Never Drill Into Tank—Hazardous Voltage, Contains Pressurized SF <sub>6</sub> Gas	G-6682
D	<b>⚠ DANGER</b>	Keep Away—Hazardous Voltage (“Mr. Ouch”)	G-6699
E	<b>⚠ WARNING</b>	Check Gas Pressure Before Operating Switchgear	G-6686
F	<b>⚠ WARNING</b>	Always Test Voltage Indicator For Proper Operation	G-6689
G	<b>⚠ WARNING</b>	Always Visually Confirm Blade Position	G-6694 (Option “-L2”)

### DANGER



Vista Underground Distribution Switchgear operates at high voltage. Failure to observe the precautions below will result in serious personal injury or death.

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

1. **QUALIFIED PERSONS.** Access to Vista Underground Distribution Switchgear must be restricted only to qualified persons. See the "Qualified Persons" section on page 2.
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 flash clothing, in accordance with safe operating procedures and rules.
4. **SAFETY LABELS.** Do not remove or obscure any of the "CAUTION," "WARNING," or "DANGER" labels.
5. **CLOSING AND LOCKING ENCLOSURES.** The pad-mounted enclosure (if furnished) must be securely closed with padlocks in place at all times unless work is being performed inside the enclosure.
6. **ENERGIZED BUSHINGS.** Always assume the bushings are energized unless proved 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.
7. **BACKFEED.** Bushings, cables, load-interrupter switches, and fault interrupters may be energized by backfeed.
8. **DE-ENERGIZING, TESTING, AND GROUNDING.** Before touching any bushings or components inside the switchgear tank that are to be inspected, replaced, serviced, or repaired, always disconnect load-interrupter switches and fault interrupters from all power sources (including backfeed), test for voltage, and properly ground.
9. **TESTING.** Test the bushings for voltage using the **Voltage Indication** feature (if furnished) or other proper high-voltage test equipment before touching any bushings or components inside the switchgear tank that are to be inspected, replaced, serviced, or repaired.
10. **GROUNDING.** Make sure the switchgear tank and pad-mounted enclosure (if furnished) are properly grounded to the station or facility ground. 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 inside the switchgear tank that are to be inspected, replaced, serviced, or repaired.
11. **LOAD-INTERRUPTER SWITCH AND FAULT-INTERRUPTER POSITION.** Always confirm the **Open/Close/Grounded** position of load-interrupter switches and fault interrupters by visually observing the position of the blades. Load-interrupter switches and fault interrupters may be energized by backfeed. Load-interrupter switches and fault interrupters may be energized in any position.
12. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized bushings.



### Overview of Components

Vista Underground Distribution Switchgear features load-interrupter switches for switching 600-ampere main feeders. The switchgear also features microprocessor-controlled, resettable vacuum fault interrupters for switching and protection of 600-ampere main feeders and 200-ampere taps, laterals, and subloops. These elbow-connected components are enclosed in a submersible, gas-insulated, and hermetically sealed welded-steel tank. UnderCover™ Style (for installation below grade), vault-mounted, and pad-mounted switchgear styles are available. See Figures 1 through 3 and Figures 4 and 5 on page 8.

The three-position (CLOSED/OPEN/GROUNDED) load-interrupter switches are manually operated and provide three-pole live switching of 600-ampere three-phase circuits. These switches also provide a visible gap when open and internal grounding for all three phases.

The 200-ampere and 600-ampere fault interrupters feature resettable vacuum interrupters in series with manually operated three-position (CLOSED/OPEN/GROUNDED) disconnects for isolation and internal grounding of each phase. Fault interrupters provide three-pole load switching and fault interruption through 25 kA symmetrical, or single-pole load switching and fault interruption through 12.5 kA symmetrical (for other possible ratings, refer to the nearest S&C Sales Office). Fault interruption is initiated by a programmable over-current control. For single-pole fault interrupters, the overcurrent control can also be programmed to provide three-pole fault interruption. See S&C Instruction Sheet 681-530 for instructions on programming the control.

When the optional VOLTAGE indicator (option suffix “-L1” or “-L2”) is specified, all routine operating tasks—switching, voltage testing, and grounding—can be accomplished by a single person without cable handling or exposure to high voltage. Cable testing for faults can be performed through the back of a user-supplied elbow with insert or feedthrough bushing insert, eliminating the need for cable handling or parking stands.

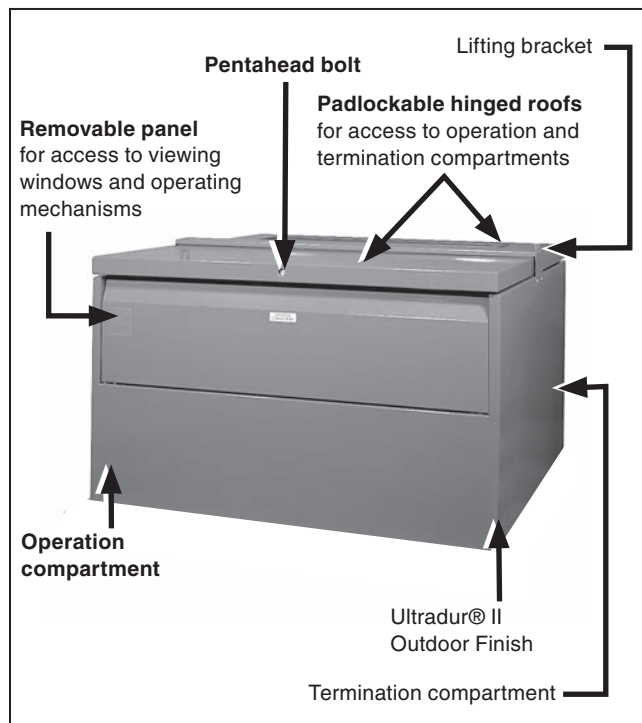


Figure 1. Pad-mounted enclosure (if furnished).

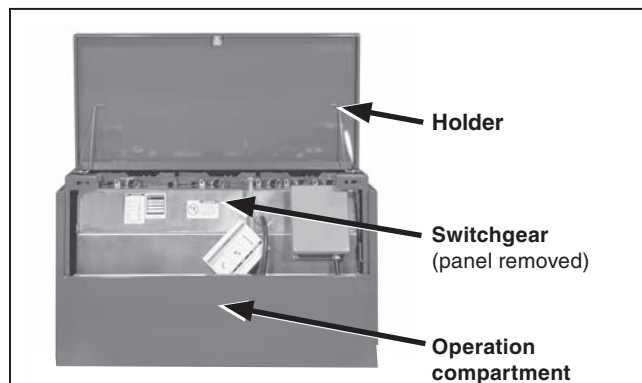


Figure 2. Operation compartment (panel removed).

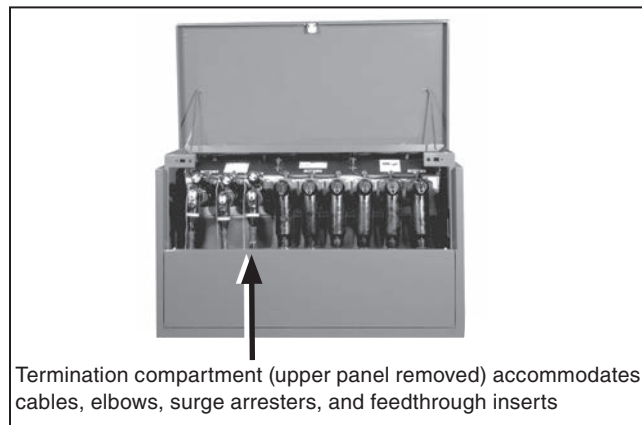


Figure 3. Termination compartment (panel removed).

# Components

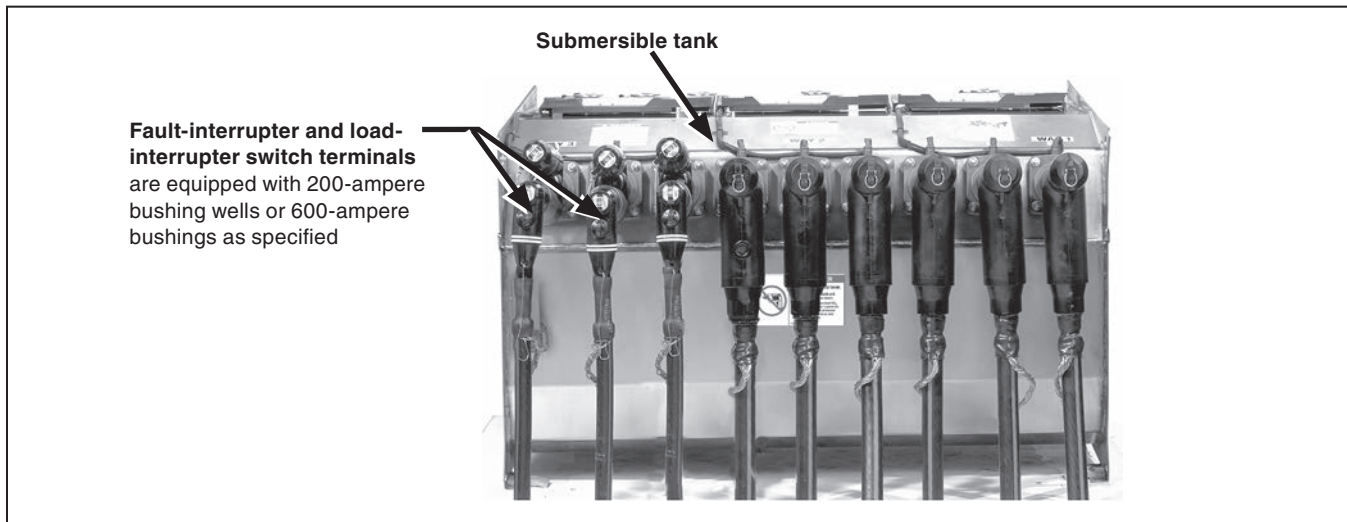


Figure 4. Termination side of switchgear.

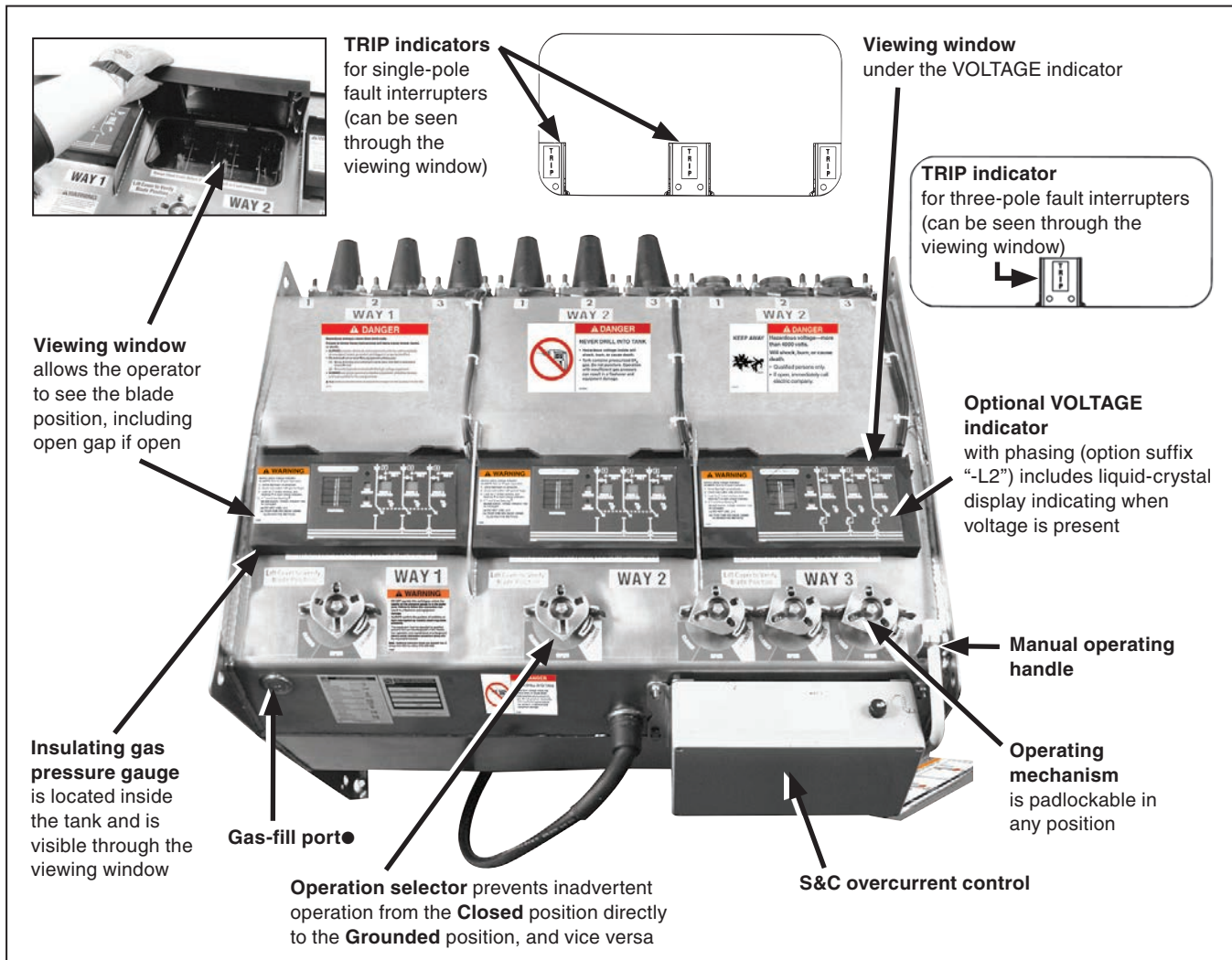


Figure 5. Top of switchgear.

● The gas-fill port is field-accessible for SF<sub>6</sub> models. For Vista Green switchgear models, the gas-fill port is designed to prevent field-refilling.



### Understanding the Gas-Pressure Gauge

Vista switchgear incorporates a temperature-compensated gas-pressure gauge inside the tank to provide indication of the insulating gas pressure. The gas-pressure gauge includes four distinct color-coded zones. See Figures 6 through 8.

If the needle is within a particular zone as described below, it indicates the following:

#### Green zone:

The Vista switchgear unit is OK to operate.

#### Green/Yellow zone:

The Vista switchgear unit may have lost some gas but is still OK to operate.

**For SF<sub>6</sub> models:** The Vista switchgear unit should be evaluated to determine whether it needs to be refilled with SF<sub>6</sub> gas via the field-accessible fill port and repaired accordingly. Contact S&C for assistance.



Vista Green switchgear models are hermetically sealed. The gas-fill port is not accessible in the field as standard. Contact S&C for assistance.

#### Red zone:

The insulating gas may be below the minimum operating pressure for the gear. **Vista switchgear should not be operated if the needle is in the red zone.** Contact S&C for assistance.

#### Orange zone:

The Vista switchgear unit has been overfilled or has a defective pressure gauge. For SF<sub>6</sub> models and field-accessible ports, an external gauge can be used instead to verify the gas pressure before operation of the device. Contact S&C for assistance.



Vista Green switchgear models are hermetically sealed. The gas-fill port is not accessible in the field as standard. Contact S&C for assistance.

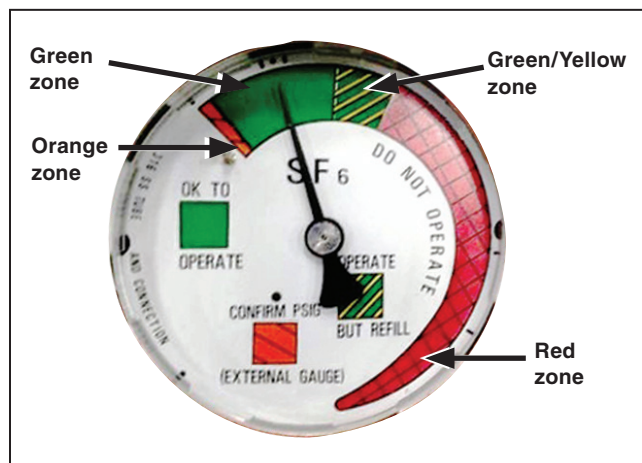


Figure 6. Internal gas-pressure gauge for most SF<sub>6</sub> models.

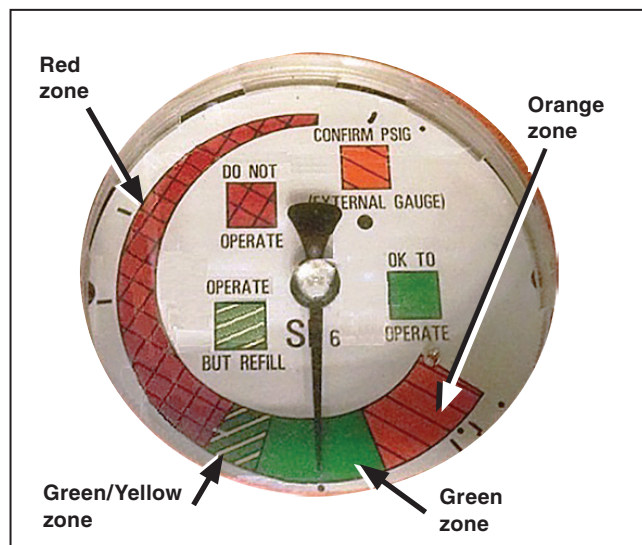


Figure 7. Internal gas-pressure gauge for SF<sub>6</sub> models rated 15 kV, 12.5 kA sym. short circuit that have catalog numbers ending with “-R1” suffix.

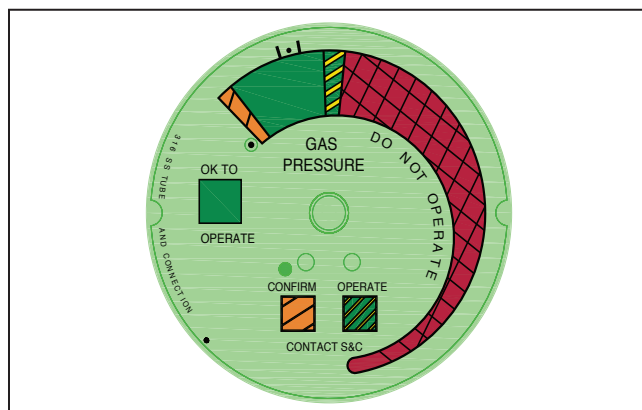


Figure 8. Internal gas-pressure gauge Vista Green switchgear models with “-GRN” catalog numbers.

### Gauge Needle Fluctuations from Rapid Ambient Temperature Changes

When the Vista switchgear tank experiences rapid changes in ambient temperature, the gas-pressure gauge needle may temporarily move to indicate a higher gas pressure when the tank is rapidly cooled or a lower gas pressure when the tank is rapidly heated. This phenomenon may occur, for instance, with sudden, direct exposure to intense sunlight.

The gas-pressure gauge uses a small reference gas chamber filled with helium to compensate for ambient temperature and altitude without applying correction factors. The gauge indicates tank pressure by measuring the pressure differential between the gas in the tank and the gas in the gauge. When the tank experiences rapid ambient temperature changes, the smaller volume of gas inside the gauge can change temperature more quickly than the larger volume of gas in the tank, which can lead to temporary movement of the needle. When the temperature stabilizes, the needle will return to its previous position within 1-2 hours.

**For SF<sub>6</sub> units:** If a sudden drop or increase in pressure is seen on the gauge, S&C recommends checking with an external gauge or waiting for ambient temperature conditions to stabilize to confirm the needle has returned to its nominal position.



Vista Green switchgear models are hermetically sealed. The gas-fill port is not accessible in the field as standard. Contact S&C for assistance.

## Pre-Operation Checks

### **⚠ WARNING**

Do not operate this switchgear if the gas-pressure gauge is in the Red zone. **Failure to follow this precaution can result in a flashover, injury, and equipment damage.**

**STEP 1.** Make sure the insulating gas pressure gauge is in the Green zone (or the Green-and-Yellow striped zone) by lifting the viewing window cover over way one. See Figure 9.

**Note:** If the SF<sub>6</sub>-gas pressure gauge is in the Green-and-Yellow striped zone, the switchgear can be operated but the tank must be repaired (if necessary) and refilled with SF<sub>6</sub> gas as soon as possible.



**Note:** If the Vista Green switchgear gas is in the Green-and-Yellow striped zone, the switchgear can be operated but must be serviced. Contact S&C for assistance.



**Figure 9.** Window cover lifts for viewing of switch or fault-interrupter blade positions.

## Operation

**STEP 2.** Open the viewing window cover and confirm the position of the load-interrupter switch or fault interrupter by visually observing the position of the blades.

For most Vista switchgear model fault interrupters, confirm the position of the trip flags. For “-R1” suffix models, confirm the position of the disconnect switch blade through the viewing window. See Figure 9 on page 11 and Figure 10.

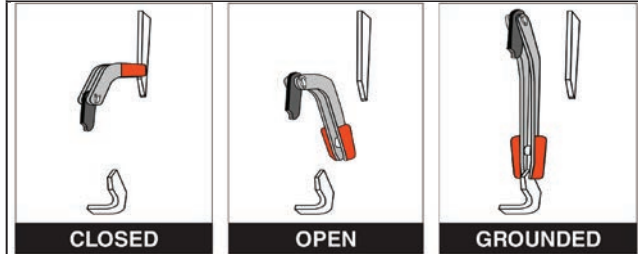
Also, inspect the current-carrying components inside the tank specifically for dislodged hardware, signs of arcing, and significant blade misalignment.

### **⚠ WARNING**

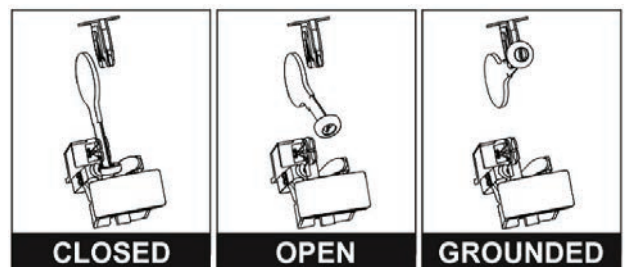
**DO NOT** operate the energized load interrupter switch or fault interrupter with dislodged hardware or obvious signs of arcing or significant blade misalignment. Equipment damage and personal injury may result.

### **⚠ WARNING**

ALWAYS confirm the position of switches or fault interrupters by VISUALLY OBSERVING blade position. **Failure to follow this precaution can result in an injury or equipment damage.**



Blade positioning for most Vista models.



Blade positioning for 15-kV, 12-kA models with “-R1” suffix

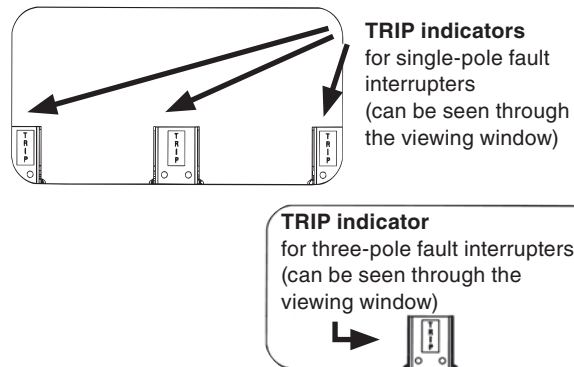


Figure 10. Confirm blade position of load-interrupter switch or fault interrupter.

**STEP 3.** If the OPERATION selector is blocking the operation, rotate the selector out of the way. The OPERATION selector prevents inadvertent operation directly from the **Closed** position to the **Grounded** position, and vice versa. See Figures 11 through 13.

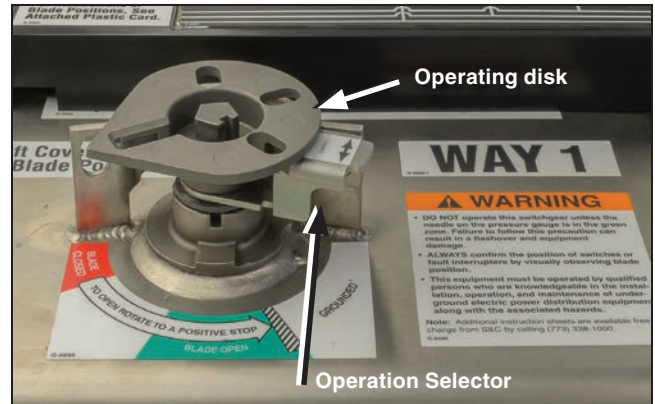


Figure 11. In the far right position, the OPERATION selector allows operation between the Closed and Open positions.

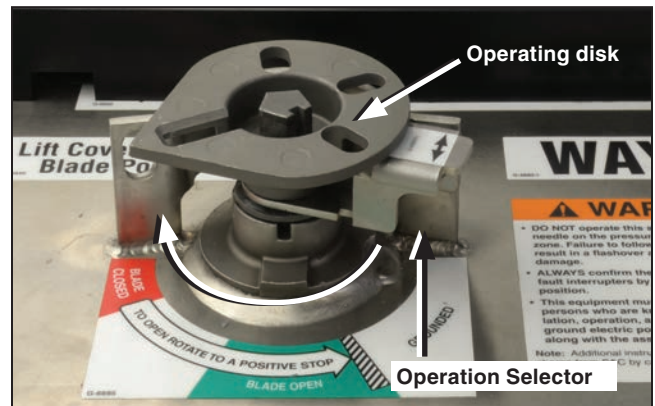


Figure 12. Rotating the OPERATION selector out of the way.

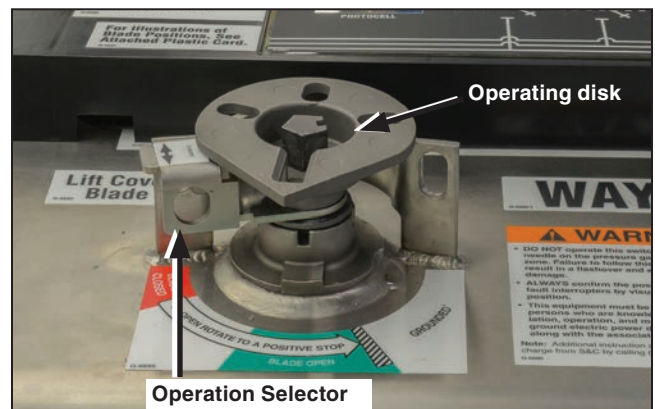


Figure 13. In the far left position, the OPERATION selector allows operation between the Open and Grounded positions.



## Operating from Closed to Open Position

### **⚠ WARNING**

Make sure to complete pre-operational checks shown on pages 11 through 13 prior to operation. **Failure to do so can result in equipment damage and personal injury.**

- STEP 1.** Make sure Steps 1 through 3 on in the “Pre-Operation Checks” section on pages 11 through 13 are completed.
- STEP 2.** Insert the manual operating handle into the notch of the operating mechanism. See Figure 14.
- STEP 3.** Rotate the manual operating handle in the counterclockwise direction to the **Open** position to open the load-interrupter switch or fault interrupter. See Figures 15 and 16.
- STEP 4.** When operating from the **Closed** to **Open** position, the operating handle must be rotated all the way to the **Stop** position, as shown on the label, to open (and recharge) the mechanism. See Figure 16. For three-pole fault interrupters, the operating handle cannot be removed until the mechanism is fully charged.
- STEP 5.** Open the viewing window cover and confirm the position of the load-interrupter switch or fault interrupter by visually observing the position of the blades.

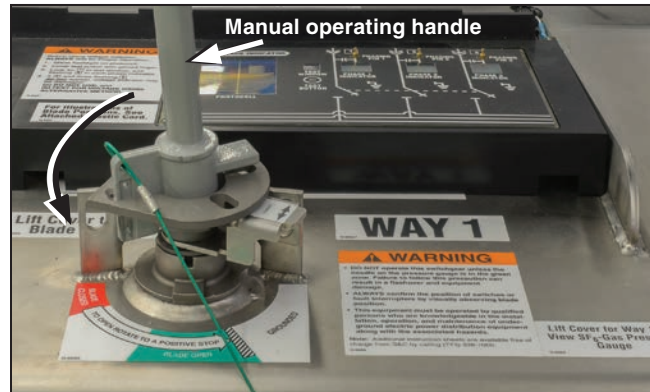


Figure 14. Opening the load-interrupter switch or fault interrupter.



Figure 15. Rotate all the way to the Stop position.



Figure 16. The load-interrupter switch or fault interrupter in the Open position.

### Operating from Open to Grounded Position

**⚠ WARNING**

Make sure to complete pre-operational checks shown on pages 11 through 13 prior to operation. **Failure to do so can result in equipment damage and personal injury.**

- STEP 1.** Make sure Steps 1 through 3 on pages 11 through 13 are completed.
- STEP 2.** Make sure the cables connected to the load-interrupter switch or fault interrupter are de-energized. Check for voltage using the optional VOLTAGE indicator (option suffix “-L1” or “-L2”), as instructed under the “Checking for Voltage Using Optional Voltage Indicator” section on page 21, or use an alternate method.
- STEP 3.** Insert the manual operating handle into the notch of the operating mechanism.
- STEP 4.** Rotate the manual operating handle in the counterclockwise direction to a stop in the **Grounded** position. See Figures 17 and 18.
- STEP 5.** Open the viewing window cover again and confirm the position of the load-interrupter switch or fault interrupter by visually observing the position of the blades.



Figure 17. Operating from Open to Ground Position.



Figure 18. The load-interrupter switch or fault interrupter in the Grounded position.

## Operating from Grounded to Open Position

### **WARNING**

Make sure to complete pre-operational checks shown on pages 11 through 13 prior to operation. **Failure to do so can result in equipment damage and personal injury.**

- STEP 1.** Make sure Steps 1 through 3 on pages 11 through 13 are completed.
- STEP 2.** Insert the manual operating handle into the notch of the operating mechanism.
- STEP 3.** Rotate the manual operating handle in the clockwise direction to a stop in the **Open** position to open the load-interrupter switch or fault interrupter. See Figures 19 and 20.
- STEP 4.** Open the viewing window cover and confirm the position of the load-interrupter switch or fault interrupter by visually observing the position of the blades.



Figure 19. Operating from Grounded to Open position.



Figure 20. The load-interrupter switch or fault interrupter in the Open position.

## Operating from Open to Closed Position

### **⚠ WARNING**

Make sure to complete pre-operational checks shown on pages 11 through 13 prior to operation. **Failure to do so can result in equipment damage and personal injury.**

- STEP 1.** Make sure Steps 1 through 3 on pages 11 through 13 are completed.
- STEP 2.** Insert the manual operating handle into the notch of the operating mechanism.
- STEP 3.** Rotate the manual operating handle in the clockwise direction to a stop in the **Closed** position to close the load-interrupter switch or fault interrupter. See Figures 21 and 22.
- STEP 4.** Open the viewing window cover and confirm the position of the load-interrupter switch or fault interrupter by visually observing the position of the blades.



**Figure 21. Closing the load-interrupter switch or fault interrupter.**



**Figure 22. Load-interrupter switch or fault interrupter in the Closed position.**



## Resetting a Fault Interrupter After a Trip Operation

### **⚠ WARNING**

Make sure to complete pre-operational checks shown on pages 11 through 13 prior to operation. **Failure to do so can result in equipment damage and personal injury.**

- STEP 1.** Make sure Steps 1 through 3 on pages 11 through 13 are completed.
- STEP 2.** Insert the manual operating handle into the notch of the operating mechanism.
- STEP 3.** Rotate the manual operating handle in the counterclockwise direction to the **Open** position to move the blade to the **Open** position and reset the operating mechanism. See Figures 23 and 24. When operating from the **Closed** to the **Open** position, the operating handle must be rotated all the way to the **Stop** position, as shown on the label, to recharge the mechanism. See Figure 24. For three-pole fault interrupters, the operating handle cannot be removed until the mechanism is fully charged.
- STEP 4.** Open the viewing window cover and confirm the position of the load-interrupter switch or fault interrupter by visually observing the position of the blades.
- STEP 5.** To operate the fault interrupter to the **Grounded** or **Closed** positions, follow the corresponding procedures on page 15 or page 17.



Figure 23. Rotate operating handle counterclockwise to the Open position.

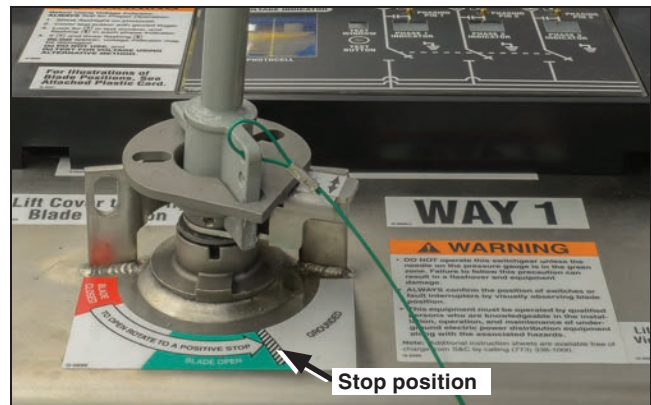


Figure 24. Rotate all the way to the Stop position.



Figure 25. The fault interrupter in the Open position.



### Locking Out of the Grounded position

To prevent the operation of a load-interrupter switch or fault interrupter into the **Grounded** position, insert a padlock through the OPERATION selector and the right-side hole of the locking collar. See Figure 26.

### Locking Out of the Closed position

To prevent the operation of a load-interrupter switch or fault interrupter into the **Closed** position, insert a padlock through the OPERATION selector and the left-side hole of the locking collar. See Figure 27.



Figure 26. Locked out of the Grounded position.

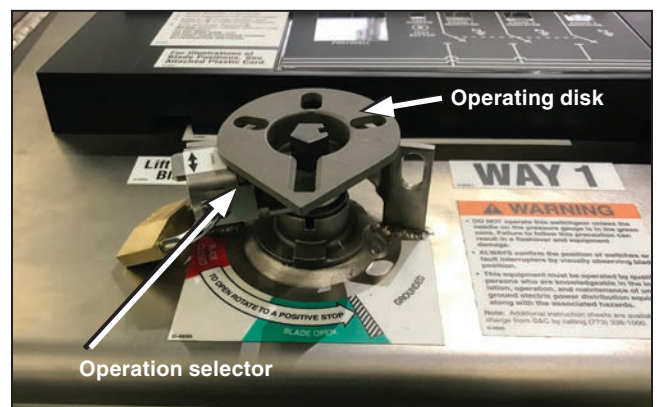


Figure 27. Locked out of the Closed position.

## Operation

### Locking In the Closed, Open, or Grounded Position

To lock a load-interrupter switch or fault interrupter into position, insert a padlock through the operating disk and the center hole in the locking collar. See Figures 28, 29, and 30.

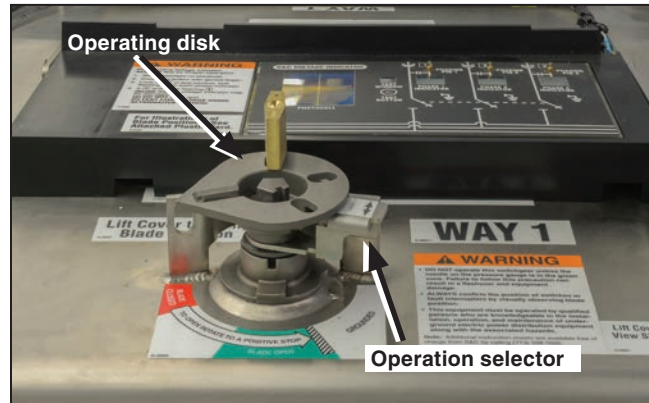


Figure 28. Locked in the Closed position.



Figure 29. Locked in the Open position.

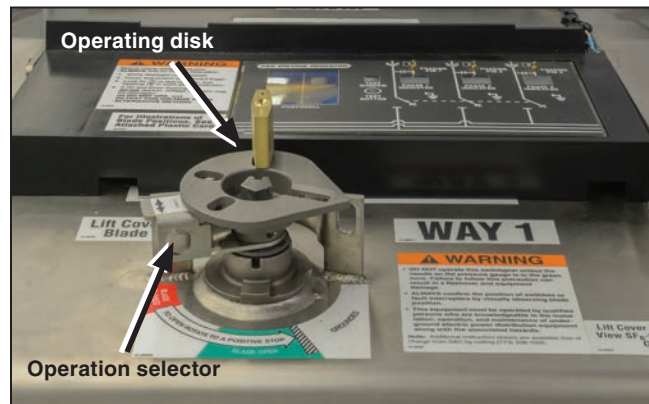


Figure 30. Locked in the Grounded position.


## Checking for Voltage Using Optional VOLTAGE Indicator

### ⚠ WARNING


Before using a VOLTAGE indicator, ALWAYS test for proper operation. If the VOLTAGE indicator is not operating properly, test for voltage using an alternate method. **Failure to follow this precaution can result in an injury or equipment damage.**

**STEP 1.** Clean the surface of the VOLTAGE indicator to remove dirt and debris. See Figure 31.

### NOTICE

When cleaning the surface of the VOLTAGE indicator, make sure the TEST button is thoroughly cleaned to remove dirt and debris. If light is blocked from the photoreceptor and the sun is bright enough to power the test circuit, the VOLTAGE indicator will be in the test mode and may give a false indication that all three phases of the associated load-interrupter switch or fault interrupter are energized. The Test mode is indicated by a dot  in the Test window.

**STEP 2.** Test the VOLTAGE indicator (complete voltage-indication circuit and phasing circuit, if furnished) for proper operation as follows:

- (a) Shine a flashlight approximately 4 inches (102 mm) above the photocell, and simultaneously cover the test button with a gloved finger. See Figure 32. When the sun is shining brightly, it can be used to power the test circuit.
- (b) If a dot  appears in the Test window and a flashing lightning bolt ⚡ in each of the three PHASE indicators, then the VOLTAGE indicator is operating properly. See Figure 33.

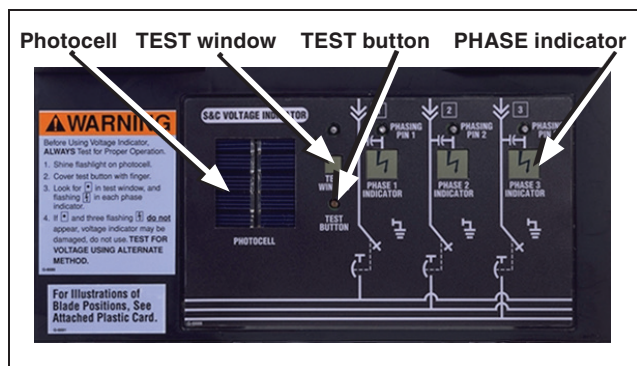


Figure 31. VOLTAGE indicator with a Test feature.

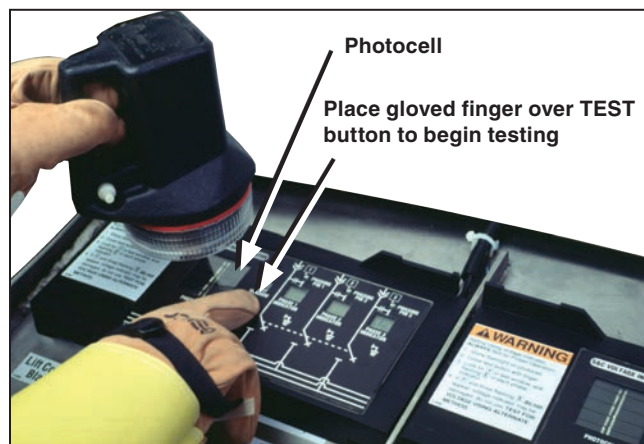


Figure 32. Test the VOLTAGE indicator by shining flashlight above the photocell and covering Test button with a gloved finger.

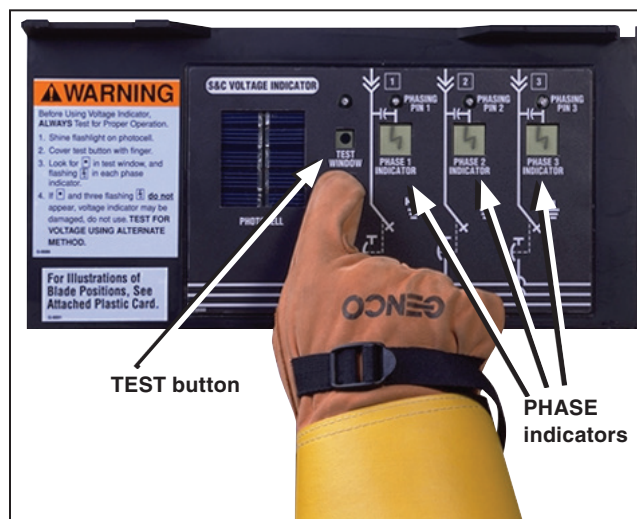


Figure 33. The presence of a dot in Test window indicates the VOLTAGE indicator is in Test mode.





- (c) If the dot  or any of the flashing lightning bolts  do not appear, make sure the TEST button is completely covered with a gloved finger so no light shines on the photoreceptor and there is adequate light (provided either by a flashlight or the sun) to power the test circuit. If the dot  or any of the flashing lightning bolts  still do not appear, the VOLTAGE indicator may be damaged. Test for voltage using an alternate method. See Figures 34 and 35.



Figure 34. The absence of a dot in the Test window indicates the VOLTAGE indicator is not in Test mode.

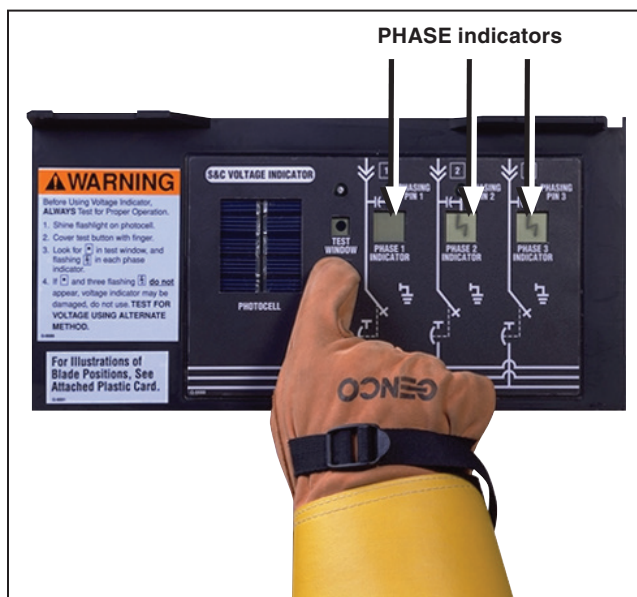


Figure 35. If one or more PHASE indicators does not show a flashing lightning bolt during testing, the VOLTAGE indicator may be damaged. Test for voltage using an alternate method.



**STEP 3.** Check the PHASE indicators for the desired phases of the load-interrupter switch or fault interrupter to determine whether there is any voltage at the associated bushings. See Figures 36 and 37. A flashing lightning bolt ⚡ in the PHASE indicator means voltage is present at the bushing. A blank LCD panel means either:

- There is no voltage at the bushing.
- The VOLTAGE indicator is malfunctioning.

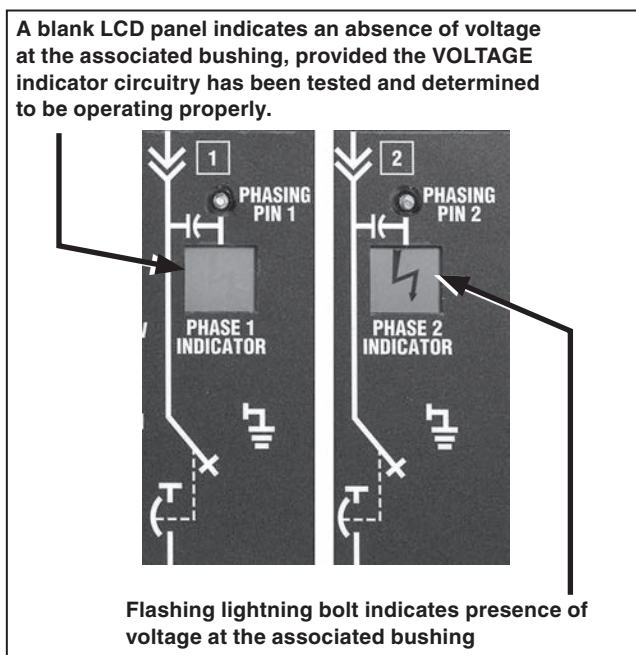


Figure 36. Indication of the presence or absence of voltage.

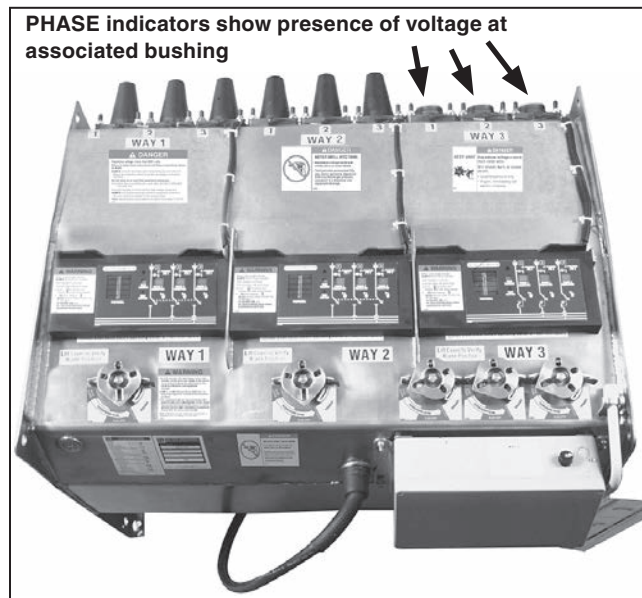


Figure 37. Each VOLTAGE indicator is provided with three phase indicators—one for each phase.



## Low-Voltage Phasing Using Optional VOLTAGE indicator with Phasing

**STEP 1.** Clean the surface and phasing pins of the VOLTAGE indicator to remove dirt and debris. See Figure 38.

**STEP 2.** Test the VOLTAGE indicators for proper operation by following Step 2 under “Checking for Voltage Using Optional VOLTAGE Indicator” section on page 21. If a VOLTAGE indicator is not operating properly, phasing should be performed using an alternate method.

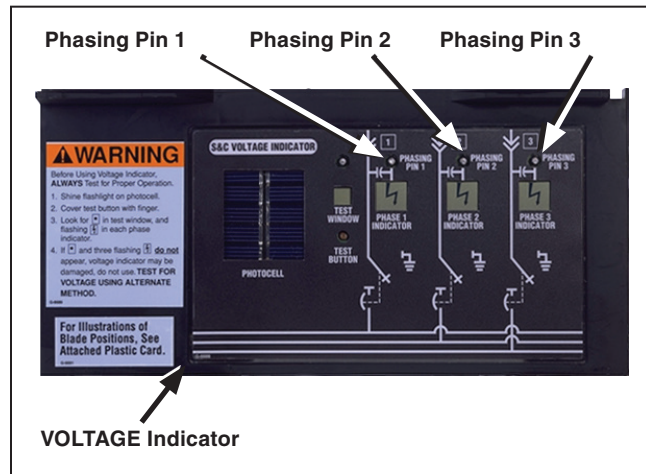
**STEP 3.** Using a high-impedance voltmeter, verify voltage is present and determine the phase-to-ground voltage for each phase of the two ways to be phased as follows:

- (a) Set the voltmeter for volts ac. See Figure 39.
- (b) Connect one of the test probes of the voltmeter to the metal tank of the switchgear to ground the voltmeter. See Figure 40.
- (c) Place the other test probe on each of the phasing pins, in turn, of the two ways to be phased and measure the phase-to-ground voltage. See Figure 38.

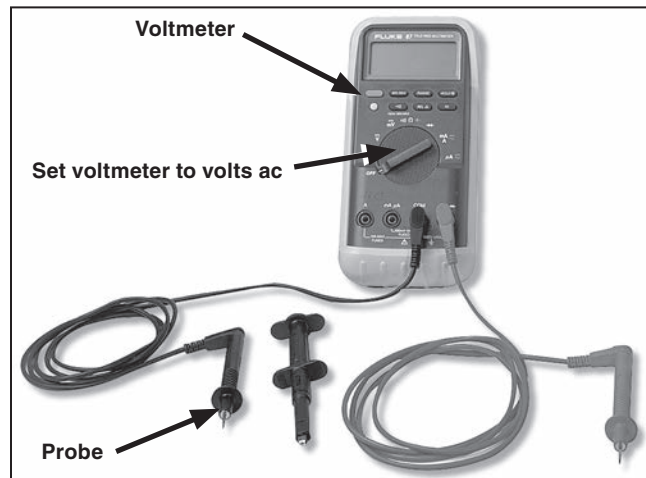
If the voltage measured at each phasing pin is greater than zero and they are equal, proceed to Step 4 on page 25.

- (d) If the voltage measured at any of the phasing pins is zero, 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.

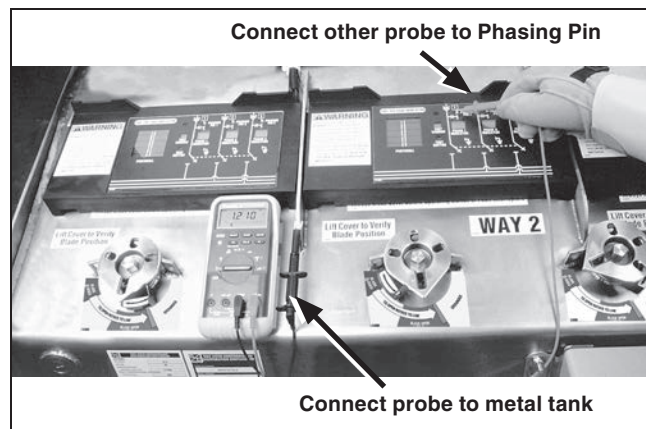
● A “way” consists of a three-phase load-interrupter switch, a three-phase fault interrupter, a bus tap, or three single-phase fault interrupters.



**Figure 38.** Before performing phasing, thoroughly clean the VOLTAGE indicator surface and phasing pins.



**Figure 39.** Voltmeter for low-voltage phasing.



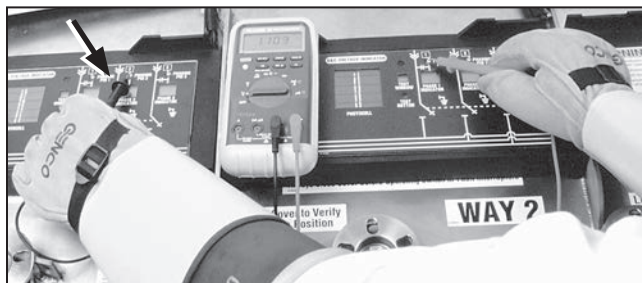
**Figure 40.** Ground the voltmeter.

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

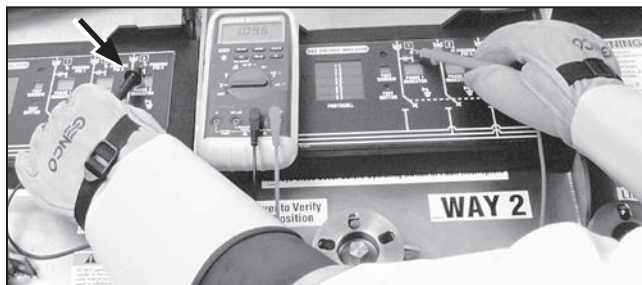
- (a) Remove the test probe of the voltmeter from the switchgear tank.
- (b) Place one of the test probes on Phasing Pin 1 of the first way and place the other probe on Phasing Pin 1 of the second way. Measure the phase-to-phase voltage. See Figure 41. When comparing the same phase of the two ways, the voltage should be zero or close to zero indicating that the cables are in phase.
- (c) Keep the test probe on Phasing Pin 1 of the second way and move the other test probe to Phasing Pin 2 of the first way. Measure the phase-to-phase voltage. See Figure 42. When comparing different phases of the two ways, the voltage should be 1.7 to 2 times the phase-to-ground voltage measured in Step 3 on page 24.
- (d) Keep the test probe on Phasing Pin 1 of the second way and move the other test probe to Phasing Pin 3 of the first way. Measure the phase-to-phase voltage. See Figure 43. Again when comparing different phases of the two ways, the voltage should be 1.7 to 2 times the phase-to-ground voltage measured in Step 3 on page 24.
- (e) Repeat Steps 4(b) through 4(d) for Phasing Pin 2 and Phasing Pin 3 of the second way.
- (f) If all of the phase-to-phase relationships are correct, the cables are in phase and are properly installed.



**Figure 41. Measuring phase-to-phase voltage—Phase 1 to Phase 1.**



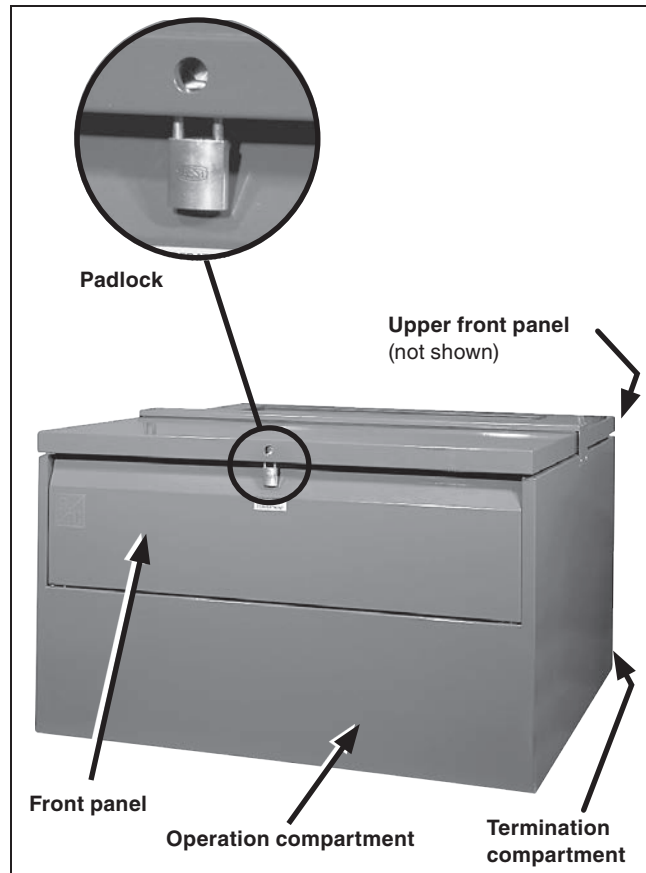
**Figure 42. Measuring phase-to-phase voltage—Phase 2 to Phase 1.**



**Figure 43. Measuring phase-to-phase voltage—Phase 3 to Phase 1.**

### Returning Equipment to Service

- STEP 1.** Make sure the load-interrupter switch and fault-interrupter grounding means are removed.
- STEP 2.** Make certain the load-interrupter switches and fault interrupters are in the correct positions (**Open** or **Closed**).
- STEP 3.** If a pad-mounted enclosure is furnished, close and padlock the termination compartment before energizing the circuit and operating any switching devices. See Figure 44.
- STEP 4.** Padlock the switchgear before leaving the site even momentarily. Observe this procedure even in those cases where the gear is accessible only to qualified persons.



**Figure 44.** Secure the enclosure. Make sure the operation compartment and termination compartments are both closed and padlocked.

## Components

No mechanical maintenance typically is required for Vista Underground Distribution Switchgear. However, occasional inspection of the switchgear and exercising of the load-interrupter switches and fault interrupters is recommended.

### DANGER

When access to the bushings or high-voltage components inside the switchgear tank is required for inspection, service, or repairs, always observe the precautions below. **Failure to observe these precautions will result in serious personal injury or death.**

1. Access to switchgear must be restricted only to a qualified person. See the “Qualified Persons” section on page 2.
2. Always follow safe operating procedures and rules.
3. Before touching any bushings or components inside the switchgear tank, always disconnect 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, 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.
5. Test the bushings for voltage using the **Voltage 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 tank 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.

★ These recommendations may differ from company operating procedures and rules. Where a discrepancy exists, users should follow their company’s operating procedures and rules.

## Enclosure Finish

The responsibility for ensuring a finish protects the pad-mounted enclosure lies with both the manufacturer and the user. The enclosure provided for pad-mounted style switchgear is finished with the 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.** Touch-up any penetration of the finish to bare metal—such as scratches and abrasions caused by shipping or vandalism—to maintain the original integrity. S&C touch-up finish and primer are available in aerosol spray cans. See Figure 45. No other finish or primer is approved. The area to be touched up should be cleaned to remove all oil and grease. Sand the area, removing 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—such as an automobile would be given—to remove surface contaminants. Use any ordinary mild household detergent solution.
- STEP 3.** In those cases where the enclosure must be refinished by the user before the finish has weathered—for example, to match other equipment—a special precaution must be taken. The entire surface must be sanded to provide a tooth to bond the new coat to the Ultradur II Outdoor Finish.

## Maintenance Recommendations in Extremely Corrosive Environments

For applications involving exposure to extremely corrosive environmental conditions (i.e. industrial chemicals, CaCl<sub>2</sub>, etc.) that may affect the condition of the switchgear tank, S&C's recommended periodic cleaning could provide extended life. Contact S&C if corrosion on the tank is found.

For outer pad-mount or custom-designed enclosures that have already experienced some corrosion, follow the instructions in the “Enclosure Finish” section for specific instructions. If no further exposure to a corrosive environment is expected, one treatment may be enough.

To remove accumulated contaminants, use a mild detergent and potable water. The detergent should be mild soap, not bleach or any cleaners that contain chloride. Cleaning alone may be sufficient in most cases, but the application of a water-displacing oil-based spray after washing is further recommended for extremely corrosive environments.



Figure 45. Order by catalog number: 9999-058 for an olive-green finish, 9999-080 for a light gray finish, and 9999-061 for red-oxide primer.



### 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 switchgear are given in Table 1. These test values are significantly greater than the normal operating voltage of the switchgear and are near the flashover voltage of the gear. 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 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.
3. Verify that the SF<sub>6</sub>-gas pressure gauge is in the Green zone.

**Table 1. Maximum Insulation Test Voltages**

Vista Switchgear Rating, kV			Withstand Test Voltage, kV	
50 Hertz	60 Hertz	Impulse (BIL)	Power Frequency <sup>①</sup>	Dc <sup>②③</sup>
12	15.5	95	27	42
24	27	125	40	62
36	38	150	50	82

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

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

③ Dc withstand test voltages are given for reference only 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 listed dc withstand test values are approximately equal to the ac peak test voltage.

### 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,” i.e., the sudden application of dc voltage from a large capacitor for the purposes 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 gear will also be subjected to the dc test voltages.

**⚠ WARNING**

The dc withstand capability of the switchgear may be reduced because of aging, damage, gas leakage, or electrical or mechanical wear. Therefore, the dc test voltage must be selected so it does not exceed the withstand limits of the switchgear. **Application of dc test voltages greater than the withstand capability of the switchgear can result in a flashover, injury, and equipment damage.**

In addition, always verify that the SF<sub>6</sub>-gas pressure gauge is in the Green zone before proceeding with any testing.

**⚠ DANGER**

Do not exceed the test voltages given in Table 2 on page 30. 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 of the dc test source, which will result in severe personal injury or death.**

Vista switchgear has been designed to allow dc testing of the cables with the other ways of the gear energized. The integral GROUNDING switch may be used to ground the cable. After testing, the dc test equipment should be used to discharge any stored charge on the cable before regrounding with the GROUNDING switch. The dc test voltages and dc cable thumping voltages should not exceed the voltages given in Table 2.

### **WARNING**

When it is necessary to test the cables connected to a unit of energized switchgear, proper isolation of the power-frequency source from the dc test source must be maintained. Follow the recommendations by the manufacturer of the dc test equipment or fault-locating equipment. The user's operating and safety procedures should be followed 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. **Failure to follow these operating and safety procedures can result in injury or equipment damage.**

**Table 2. Maximum Cable Test and Cable Thumping Voltages**

Vista Switchgear Rating, kV			Dc Cable Test Voltage, kV	Dc Cable Thumping Voltage, kV <sup>①</sup>
50 Hertz	60 Hertz	Impulse (BIL)		
12	15.5	95	30	15
24	27	125	40	20
36	38	150	40	20

① The dc cable thumping voltage is 50% of the dc cable test voltage because of voltage doubling that will occur at the open end of the cable which is assumed to be a unit of Vista 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.

### **Fault-Interrupter Testing**

When performing dielectric tests on Vista switchgear, the vacuum fault interrupters will not be subject to voltage across the open gap because the disconnect switch will isolate the vacuum interrupter from the test voltage. Because the vacuum interrupter will not be energized across the open gap, there is no exposure to 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.

## Resistance Measurement

### **⚠ DANGER**

De-energize the Vista Underground Distribution Switchgear before performing the resistance measurements described in this procedure. Follow all applicable safety procedures. **Failure to de-energize the Vista switchgear before taking resistance measurements will result in serious injury or death.**

Resistance measurements are used to look for areas of the gear that may exhibit poor contact between current carrying parts. See Figure 46.

Resistance measurements are taken using a four-terminal measuring device that provides at least 100 amperes of current to the main circuit. Resistance measurements should be taken from the bushing conductor across each Way to the same phase on each Way of the unit. For example, a measurement would be taken from Way 1 Phase A to Way 2 Phase A, from Way 2 Phase A to Way 3 Phase A, from Way 1 Phase A to Way 3 Phase A, from Way 1 Phase B to Way 2 Phase B; etc.

To measure resistance, perform the following procedure:

**STEP 1.** Clamp the two current-carrying probes of the resistance-measuring device to the bushing conductors of the current-carrying path to be measured. See Figure 46. In this example the resistance is being taken between Way 1 Phase A and Way 2 Phase A.

**STEP 2.**

### **NOTICE**

DO NOT take resistance measurements from the threaded area of the bushing stud. Resistance measurements taken through the threads of the bushing stud will be inaccurate.

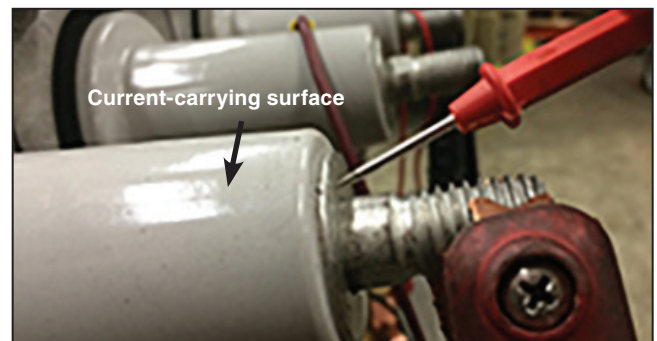
Clamp or touch the voltage-carrying probes of the resistance measuring device to the flat conductive surface of the bushings that make up the current carrying path. Make sure the measurement probe is in contact with the current-carrying flat face of the bushing conductor rod. If using clamp-style probes, slide the clamp all the way up against the current-carrying face to get a good connection. See Figure 47.

**STEP 3.** Record the resistance measurement. Acceptable resistance values are:

- Under 500 microohms
- Under 600 microohms for tie switches



**Figure 46. Connecting the resistance measuring device.●**



**Figure 47. Take the measurement from the flat current-carrying surface of the bushing.●**

● Adhere to your company's standards in regards to using hand PPE when taking resistance measurements.