# Installation

This green leaf icon designates information specifically for Vista® Green Underground Distribution Switchgear that uses a $CO_2$ mix insulating gas. Unless otherwise designated, instructions provided apply to all manual Vista switchgear products.

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## 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 Underground Distribution Switchgear. Become familiar with the "Safety Information" section on pages 4 through 5 and "Safety Precautions" section on page 6. The latest version of this publication is available online in PDF format at **sandc.com/en/product–literature/**.

**Note:** Instruction sheets covering the installation and operation of Vista Underground Distribution Switchgear are included in the "Installation and Operation Information Kit" provided with each switchgear assembly. A catalog dimensional drawing showing cable locations and anchor-bolt dimensions is also provided in the information kit. All personnel involved with installation and operation of the gear should be thoroughly familiar with the contents of this kit.

This instruction sheet covers the installation of Vista Underground Distribution Switchgear.

Along with this instruction sheet are copies of:

- S&C Instruction Sheet 681-510, "Vista® Underground Distribution Switchgear Under-Cover™, Vault-Mounted, and Pad-Mounted Styles: *Operation*"
- S&C Instruction Sheet 681-530, "Vista® Underground Distribution Switchgear: *Programming*"
- Reference drawings detailing the installation of cable support brackets and wiring diagrams for the current transformers (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.)

Various optional features are available for Vista switchgear. The catalog number stamped on the nameplate affixed to the switchgear is suffixed with letter-number combinations applicable to the gear furnished.

## Retain this Instruction Sheet

This instruction sheet is a permanent part of Vista Underground Distribution Switchgear. Designate a location where users can easily retrieve and refer to this publication. The latest version is available online in PDF format at **sandc.com/en/product–literature/**.

## 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 Specification Bulletin 681-31 for more information.

## Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels attached to the Vista Underground Distribution Switchgear. Become familiar with these 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 Technical Assistance Center at 1-888-762-1100.

***NOTICE***

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



## Replacement Instructions and Labels

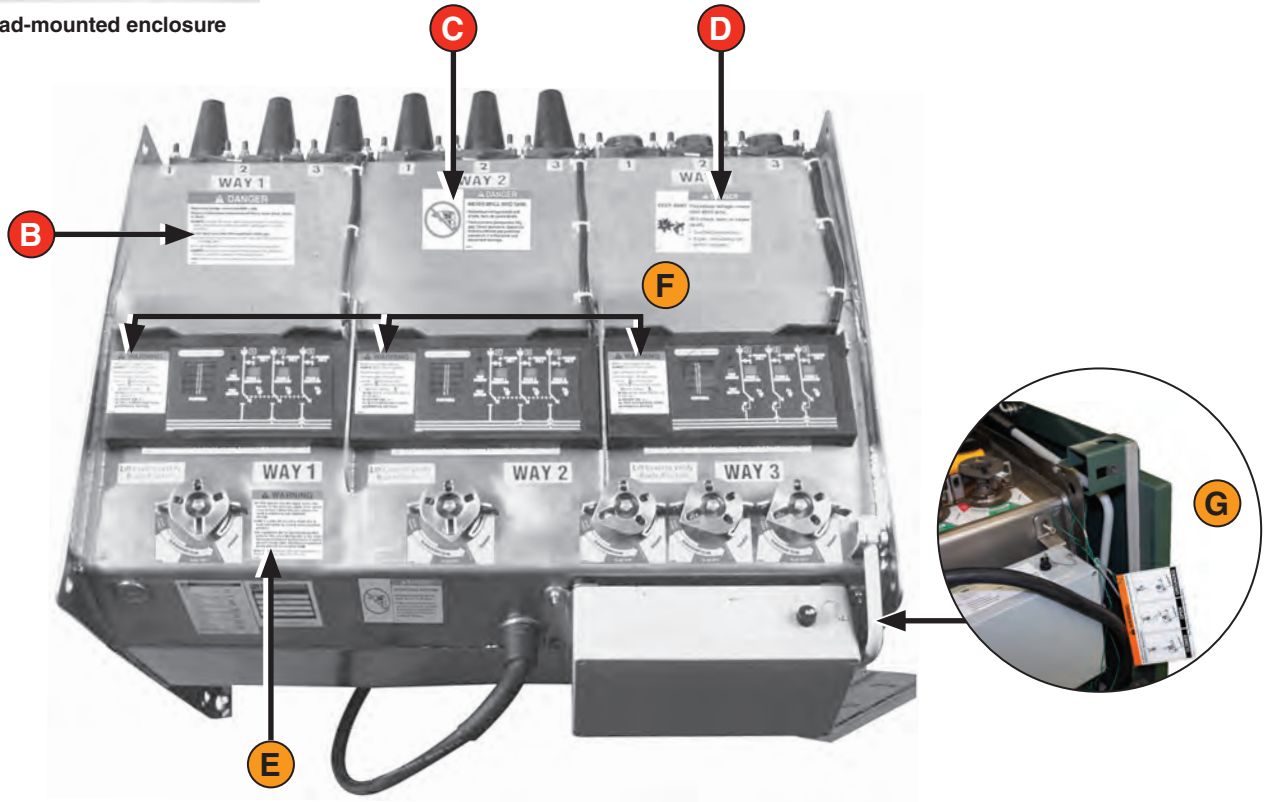
If additional copies of this instruction sheet are required, contact the nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

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




Pad-mounted enclosure




Top of switchgear

### Reorder Information for Safety Labels

| Location | Safety Alert Message | Description | Part Number |
|---|---|---|---|
| A | ⚠ WARNING | Keep Out—Hazardous Voltage Inside | G-6681 |
| B | ⚠ DANGER | Hazardous Voltage—Always Consider Circuits and Components Live . . . | G-6700 |
| C | ⚠ DANGER | Never Drill Into Tank—Hazardous Voltage, Contains Pressurized Gas | G-6682 |
| D | ⚠ DANGER | Keep Away—Hazardous Voltage (“Mr. Ouch”) | G-6699 |
| E | ⚠ WARNING | Check Gas Pressure Before Operating Switchgear | G-6686 |
| F | ⚠ WARNING | Always Test Voltage Indicator For Proper Operation | G-6689 |
| G | ⚠ WARNING | Always Visually Confirm Blade Position | G-6693<br>G-6694<br>(Option “-L2”) |

## ⚠ DANGER



**Vista 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 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 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. **DOORS.** High-voltage compartment doors must be securely closed and latched, with padlocks in place at all times unless work is being performed inside the enclosure.
6. **KEY INTERLOCKS.** Optional key interlocks, if furnished, must be in place. Check the operating sequence of 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.
7. **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.
8. **ENERGIZED BUSHINGS.** Always assume the bushings are energized unless proven otherwise by test, by visual evidence of an open-circuit condition at the load-interrupter switch or fault interrupter, or by observing that the load-interrupter switch or fault interrupter is grounded.
9. **BACKFEED.** Bushings, cables, load-interrupter switches, and fault interrupters may be energized by backfeed.
10. **GROUNDING.**
    - Vista switchgear must be connected to a suitable earth ground before energizing and at all times when energized.
    - The ground wire(s) must be bonded to the system neutral, if present. If the system neutral is not present, proper precautions must be taken to ensure the local earth ground cannot be severed or removed.
    - After the switchgear has been completely disconnected from all sources of power and tested for voltage, properly ground the load-interrupter switches and fault interrupters before touching any bushings or components that are to be inspected, replaced, serviced, or repaired.
11. **LOAD-INTERRUPTER SWITCH OR FAULT-INTERRUPTER POSITION.**
    - Always confirm the **Ground/Open/Closed** position of the load-interrupter switch or fault interrupter by visually observing the position of the isolating disconnect.
    - Be aware that the load-interrupter switch or fault interrupter may be energized by backfeed.
    - Be aware that the load-interrupter switch or fault interrupter may be energized in any position.
12. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.

## Packing

Pad-mounted style Vista switchgear consists of the gas-tight tank ($SF_6$) or hermetically sealed tank ($CO_2$ mix) and the outer enclosure. Both are fastened to a wooden skid, with the tank shipped within the outer enclosure.

At the first opportunity, remove all packing materials (cardboard, paper, foam padding, etc.) from the outside of the pad-mounted enclosure. This will prevent the finish from being damaged by rainwater absorbed by the packing materials and will also prevent wind-induced abrasion from loose cardboard.

UnderCover Style and vault-mounted style Vista Underground Distribution Switchgear are shipped in a wooden crate.

## Inspection

Examine the shipment for external evidence of damage as soon after receipt as possible, preferably before removal from the carrier's conveyance. Check the bill of lading to make sure all listed shipping skids, crates, and containers listed are present.

If there is visible loss and/or damage:

1. Notify the delivering carrier immediately.
2. Ask for a carrier inspection.
3. Note condition of shipment on all copies of the delivery receipt.
4. File a claim with the carrier.

If concealed damage is discovered:

1. Notify the delivering carrier within 15 days of receipt of shipment.
2. Ask for a carrier inspection.
3. File a claim with the carrier.

Also, notify S&C Electric Company in all instances of loss and/or damage.

## Handling

**⚠ WARNING**

When handling an enclosure or tank with an overhead hoist, observe standard lifting practices as well as the general instructions below.

**Failure to follow these precautions can result in serious personal injury or equipment damage.**

***NOTICE***

Refer to the nameplate affixed to exterior of switchgear assembly for the net weight.

**⚠ WARNING**

**DO NOT** lift the pad-mounted enclosure while it is bolted to the skid with the tank. The lifting tabs on the pad-mounted enclosure will not support the combined weight of the pad-mounted enclosure and the tank. Before lifting with slings, follow the directions under the "Enclosure Removal" section on pages 9 and 10.

**Failure to follow these precautions can result in serious personal injury or equipment damage.**

**STEP 1.** Remove and retain the anchor brackets tie wrapped to the enclosure or tank grounding pad. Use 6-foot (1829-mm) or longer hoist slings of equal length to prevent damage to the enclosure or tank during lifting. (Four-foot (1219-mm) hoist slings are acceptable for two-way and three-way enclosures and tanks.) See Figure 1, Figure 2, and Figure 3.

**STEP 2.** Arrange the hoist slings to distribute lifting forces equally between the lifting tabs.

**STEP 3.** Lift the tank or enclosure into position per the appropriate installation section. Avoid sudden starts and stops.

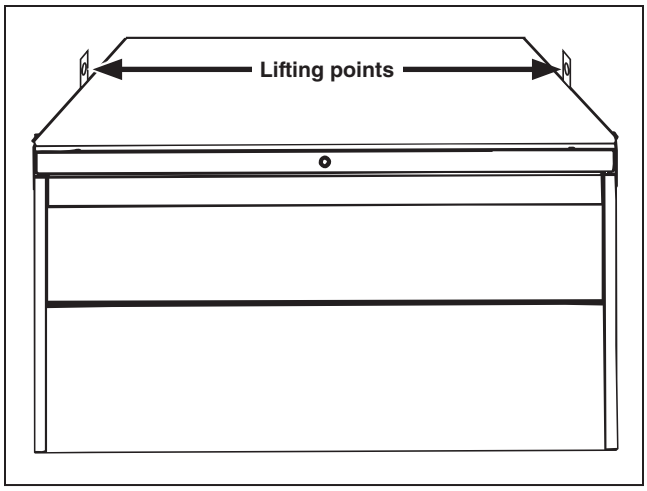



**Figure 1. The enclosure for pad-mounted style.**

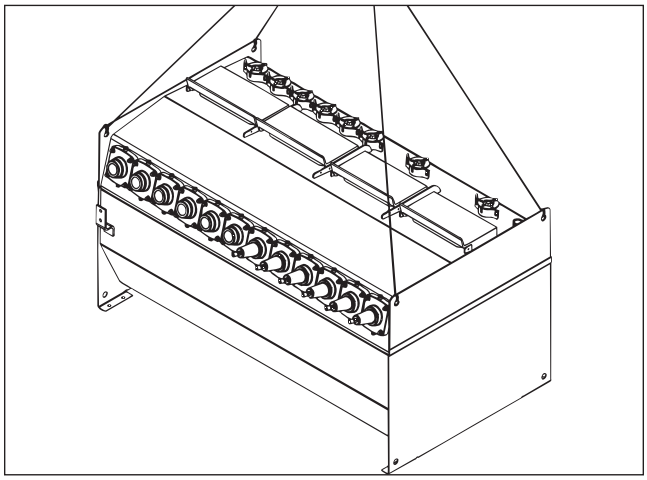


**Figure 2. A properly slung tank for the typical UnderCover style or pad-mounted style.**

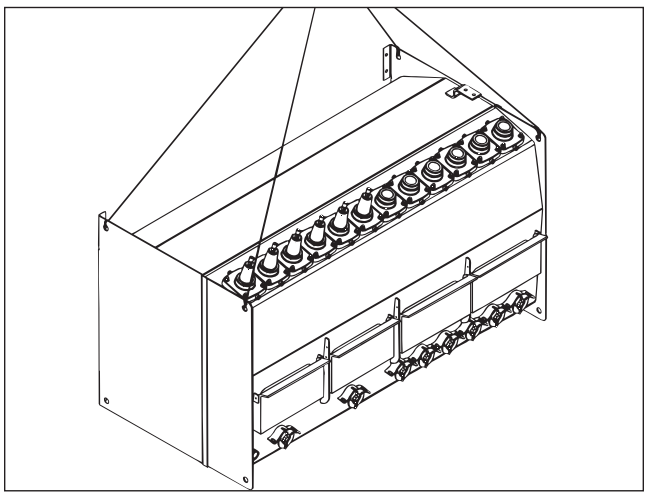


**Figure 3. A properly slung tank for the typical vault-mounted style.**

## Enclosure Removal

**NOTICE**

Custom-engineered single-lift designs are available so the tank and enclosure can be lifted together. Unless a custom single-lift design has been specified, the enclosure must be removed from the tank to be lifted or equipment damage may result.

For pad-mounted style Vista switchgear, follow these steps to remove the enclosure:

**STEP 1.** Loosen the pentahead bolts securing the hinged roofs to the enclosure using a pentahead socket wrench with extender or a pentahead tool. See Figure 4.

**STEP 2.** ***If the Vista switchgear has been ordered with optional base spacers with integral tank supports ("-W" options):*** Remove the bolts from the base spacers. See Figure 9 on page 12.

**STEP 3.** Lift the hinged roofs upward and secure them with the holders. See Figure 5.

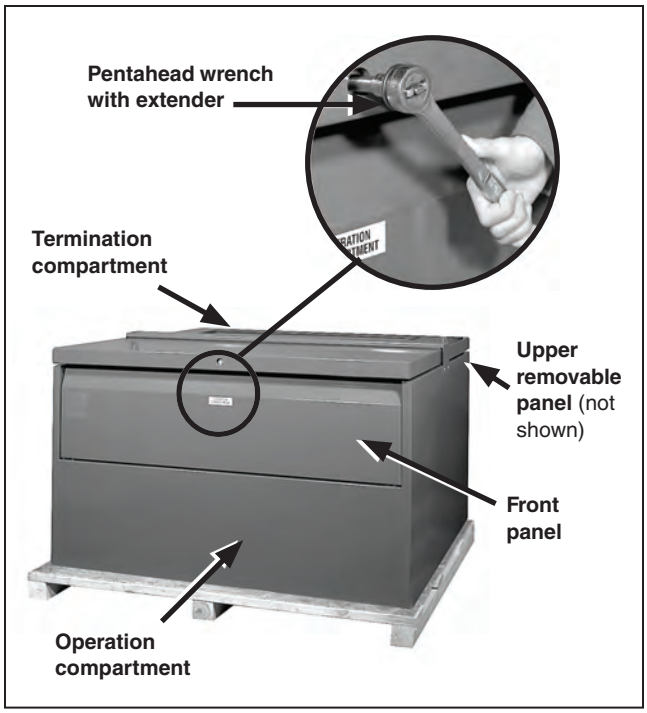



**Figure 4. A pad-mounted style Vista switchgear enclosure with the roofs closed.**

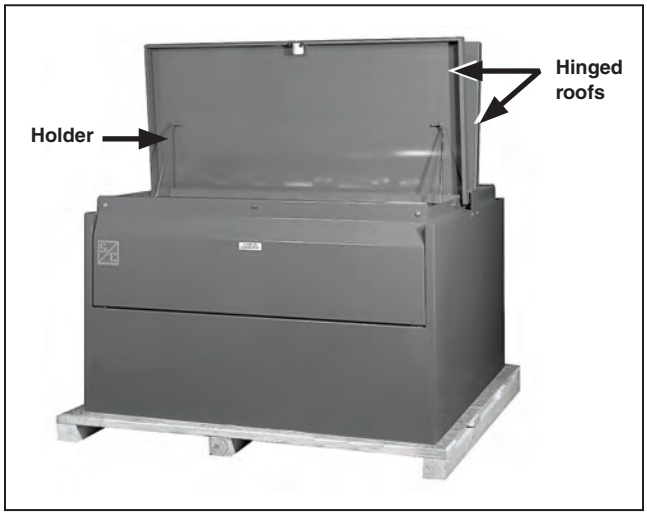



**Figure 5. A pad-mounted Vista switchgear enclosure with the roofs open.**

**STEP 4.** Remove the removable panel from the operation compartment and the upper removable panel from the termination compartment by loosening the fasteners securing the panels in place and lifting the panels upward. Set the panels aside in a safe, clean place. See Figure 6.

It is important to keep track of which side of the enclosure is the termination side and which side is the operation side after the panels are removed. The operation side has the larger opening and uses the larger panel.

**STEP 5.** Unbolt the enclosure from the skid and remove it from the tank, observing the precautions given in the "Handling" section on page 8. See Figure 7.

**STEP 6.** Before lifting the enclosure, close the hinged roofs. Make sure the low-voltage compartment door is closed.

**STEP 7.** Set the enclosure aside in a protected area.

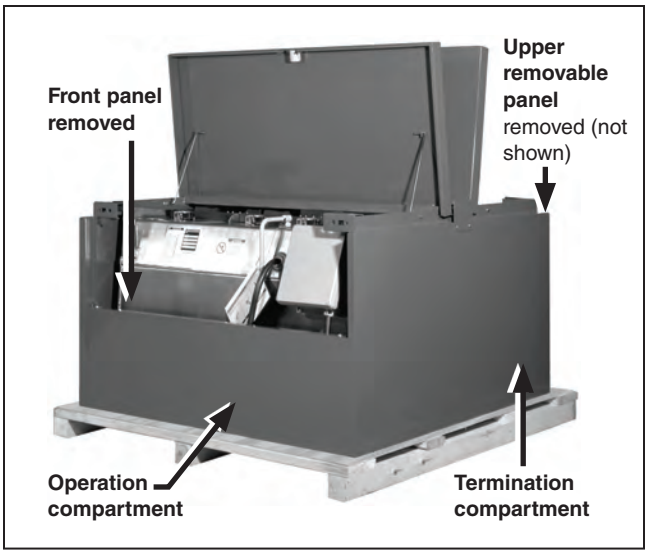



**Figure 6. A pad-mounted Vista switchgear unit with the front and upper removable panels removed.**




**Figure 7. A pad-mounted Vista switchgear enclosure being removed from the tank.**

## Tank Placement

For pad-mounted style Vista switchgear, complete the following steps for tank placement:

**STEP 1.** Remove any packing or foam from around the viewing window and check the gas-pressure gauge to make sure it is in the Green zone. Contact S&C Electric Company if the gas-pressure gauge is not in the Green zone. See the "Gas-Pressure Gauge" section on page 20 for more information.

**STEP 2.** Unbolt the tank from the skid and lift it above the mounting pad, observing the precautions given under the "Handling" section on page 8. See Figure 8. Use a four-point lifting scheme to properly balance the gear. See Figure 2 on page 8.

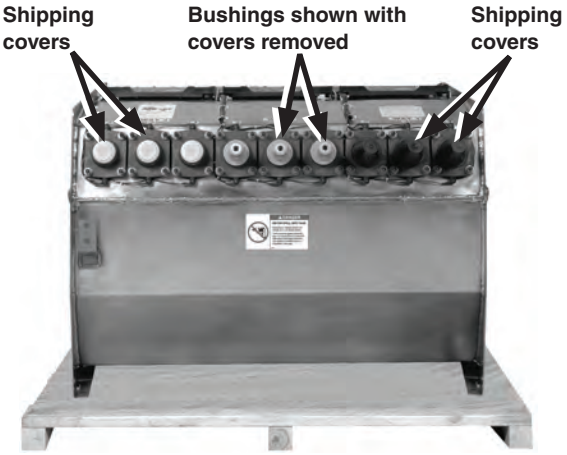
**STEP 3.** Verify the tank is positioned correctly with respect to the cables and anchor bolts.

**STEP 4.** Lower the tank into place.

**STEP 5.** Secure the tank to the pad using the anchor brackets provided. See Figure 14 on page 14.

***NOTICE***

Be sure to prevent any damage to the termination bushings or bushing wells. **Failure to comply with damage prevention will result in the tank needing to be returned to the factory for repair.**




Switchgear bolted to skid (bolts to be removed prior to lifting).

**Figure 8. A Vista switchgear tank bolted to a skid for shipment.**

## Units with Base Spacers

**Note:** Pad-mounted Vista switchgear with base spacers is also designed to accommodate a two-lift installation. When installing pad-mounted Vista switchgear with base spacers, the enclosure above the base-spacer connection should be removed first. The base spacers and tank-support rails remain connected to the base of the tank. The tank attached to the base spacer should be lifted as one unit during tank installation. See Figure 9 and Figure 10.



**Figure 9. A pad-mounted style high-voltage enclosure being removed from the base spacer.**

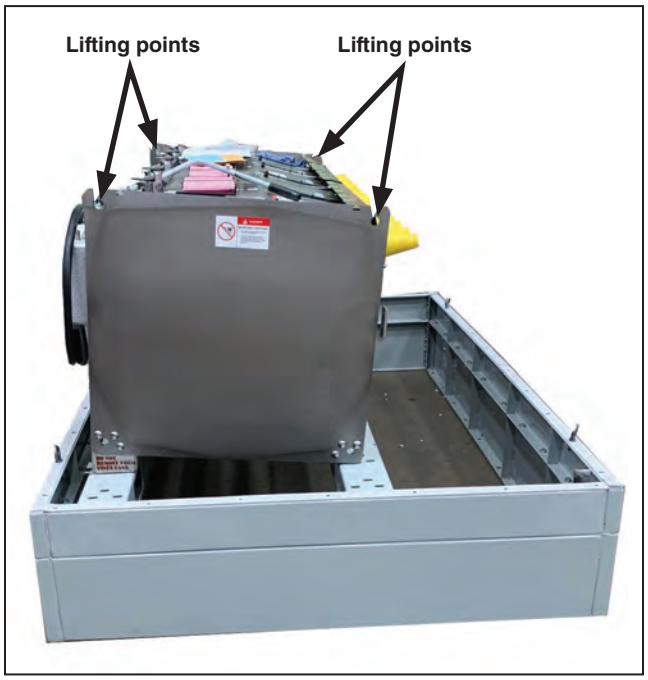



**Figure 10. A pad-mounted Vista switchgear tank attached to the support rails of the base spacer to be lifted as one unit.**

## Cable Terminations

**⚠ DANGER**

Before energizing the switchgear, replace the shipping covers on all bushing and bushing wells with elbows or insulated protective caps.

**Failure to replace the shipping covers on all bushings and bushing wells with elbows or insulated protective caps can result in a flashover and serious personal injury or death.**

**⚠ CAUTION**

**ALWAYS** follow proper cable installation practices. When installing cable that will be attached to the switchgear, provide a strain relief segment to minimize the load on the bushings. Cables must be allowed to expand and flex without putting a significant load on the bushings. For a pit, either loop the cable in the pit or bring it into the pit horizontally and up to the gear at a 90° angle.

**Failure to follow these precautions can result in minor injury as well as damage to the bushings and bushing wells and subsequent leakage of insulating gas.**

Complete the following steps for terminating cables:

**STEP 1.** Remove the shipping covers from the bushings and bushing wells. See Figure 11.

**STEP 2.** Terminate the cables with elbows, following the elbow manufacturer's instructions. See Figure 12.

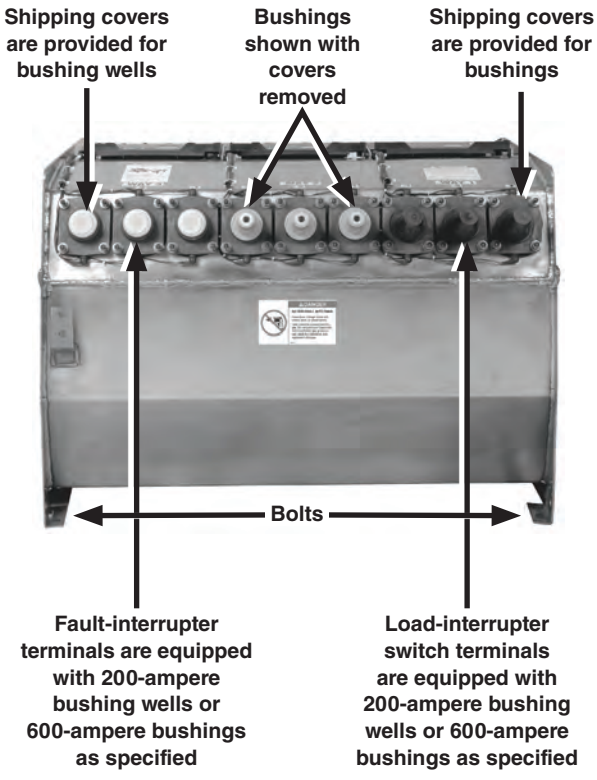



**Figure 11. The switchgear tank, as shipped. (Illustration excludes typical cabling and motor operator provisions to emphasize the location of shipping covers and bolts.)**

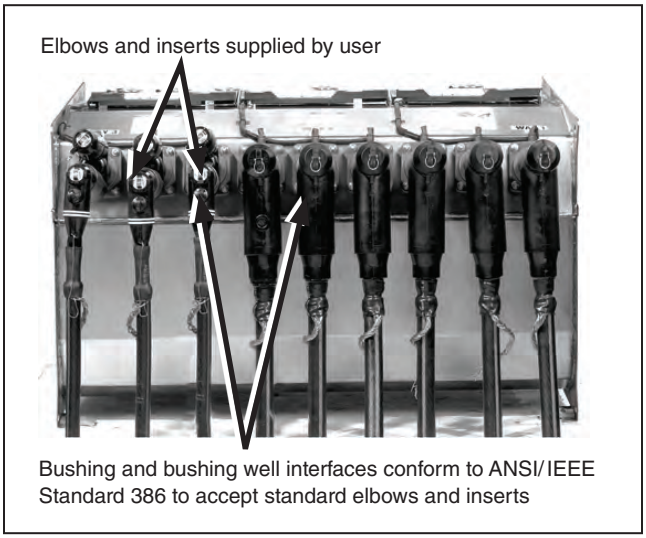



**Figure 12. A Vista switchgear tank shown with user-supplied cables and elbows.**

## Enclosure Placement

**Note:** When installing the pad-mounted enclosure over the tank, place the side of the enclosure with the "Termination Compartment" label over the terminators and the side of the enclosure with the "Operation Compartment" label over the operating mechanisms. This will ensure the compartments are properly identified and the panels are in their correct locations. The operation compartment front panel is larger.

Complete the following steps to place the enclosure for pad-mounted style Vista switchgear:

**STEP 1.** Lift the enclosure into place over the tank, observing the precautions given in the "Handling" section on page 8. See Figure 13.

**STEP 2.** Refer to the catalog dimensional drawing and verify the enclosure compartments are positioned correctly and the enclosure is properly aligned with respect to the anchor bolts.

**STEP 3.** Secure the enclosure to the pad using the anchor brackets provided. See Figure 14.

**NOTICE**

Carefully follow the catalog drawing during enclosure placement. The position of the enclosure on the skid should not be used as a guide for placing the enclosure on the pad.

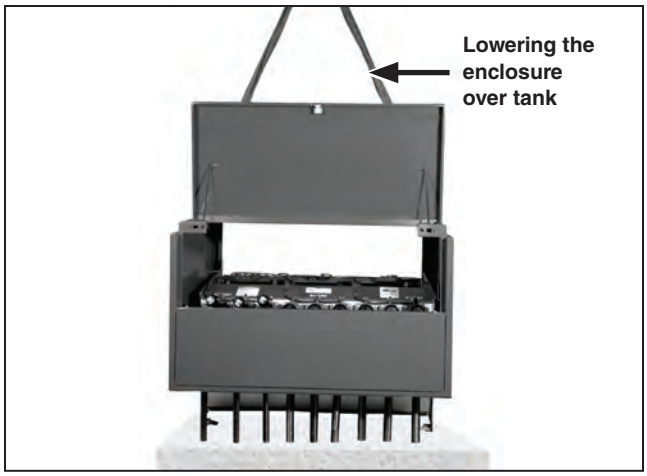



**Figure 13. A pad-mounted style enclosure being lowered over a Vista switchgear tank.**

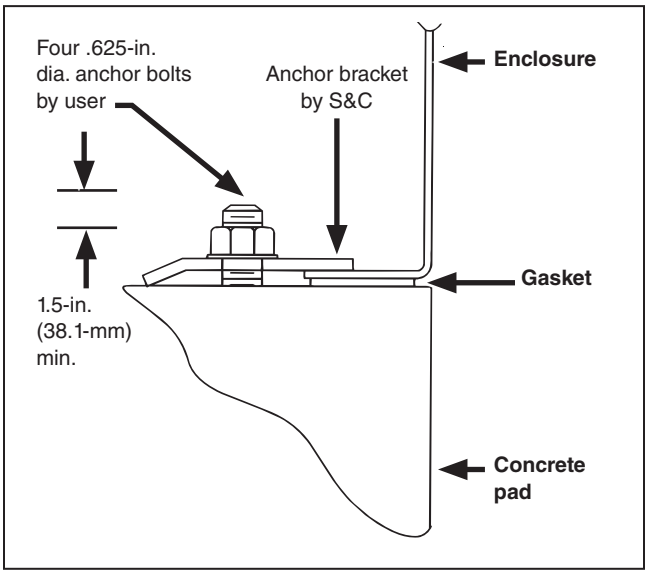



**Figure 14. A proper anchor bracket placement.**

## Grounding

Complete the following steps to properly ground pad-mounted style Vista switchgear:

**STEP 1.** Connect the cable concentric-neutral ground wires to the grounding system as appropriate.

**STEP 2.** Connect the ground pad of the tank and the ground pad inside the enclosure to the system ground facility in accordance with the user's standard grounding practice. See Figure 15 and Figure 16.

**STEP 3.** Use the equivalent of 4/0 copper (or cable sized in accordance with the user's standard practice) in either a single or multiple connection to realize the maximum momentary rating of the switchgear. For a multiple connection, cables smaller than 1/0 copper or equivalent should not be used.

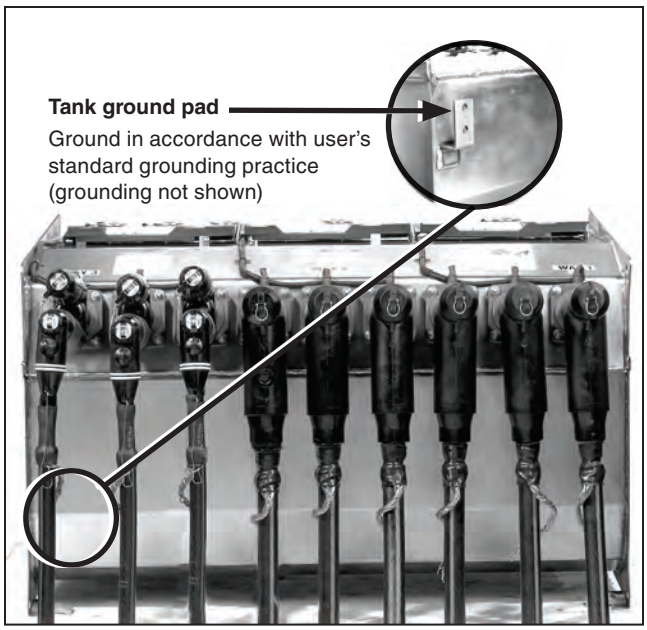



**Figure 15. The Vista switchgear tank ground pad (grounding not shown).**

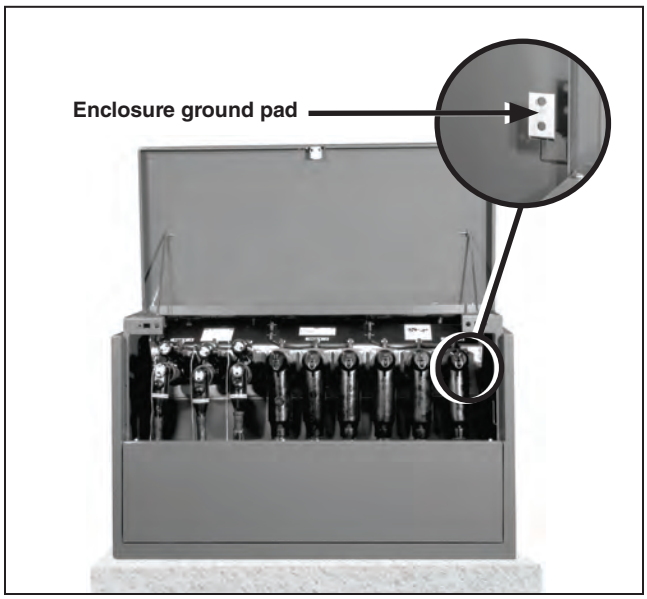



**Figure 16. The pad-mounted enclosure ground pad.**

## Fault Indicators

Fault indicators are to be furnished by the user and installed in accordance with the manufacturer's instructions. Optional mounting provisions for fault indicators are available for pad-mounted style switchgear. See Figure 17. See S&C Specification Bulletin 681-31 for ordering information.

If mounting provisions are specified, mount the fault indicators on the mounting brackets and attach the associated sensors to the cables below the cable terminations. See Figure 18.

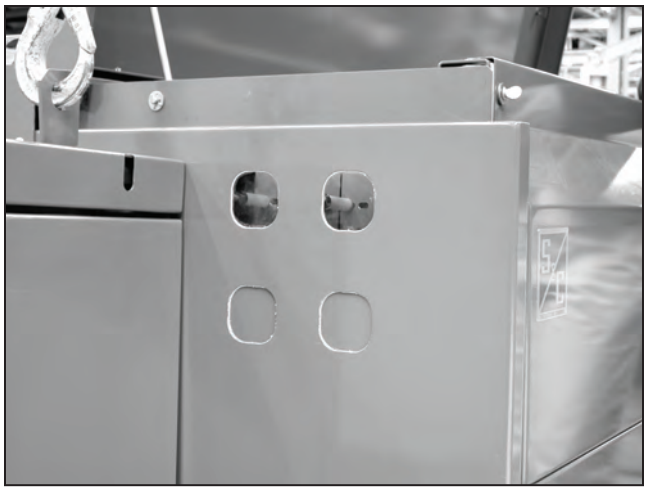


**Figure 17. The mounting provisions for user-furnished fault indicators.**



**Figure 18. The mounting brackets for user-furnished fault indicators.**

## Completing the Installation

**NOTICE**

A resilient closed-cell gasket on the bottom flange of the enclosure protects the finish from being scratched during installation, and isolates it from the alkalinity of a concrete foundation. This gasket also helps to seal the enclosure to the foundation, to guard against entry of wildlife, insects, or weeds, and to discourage tampering. If the gasket cannot compensate for an uneven foundation, grout the bottom of the enclosure as necessary. Any grout applied should be recessed enough to permit caulking.

Follow these steps to complete the installation:

**STEP 1.** Caulk around the bottom of the enclosure; a weatherproof temperature vulcanizing (RTV) silicon-rubber compound is recommended. See Figure 19.

**STEP 2.** Apply a suitable compound to fill the spaces between the cable and the conduit, and cap all empty conduits to prevent the entry of moisture and wildlife.

**STEP 3.** Reinstall the front panel of the operation compartment and the upper removable panel of the termination compartment. These panels are not interchangeable.

**STEP 4.** Lower the hinged roofs and secure them with the pentahead bolts. Then insert a padlock into each hasp. See Figure 20.

**STEP 5.** Wipe down the exterior of the enclosure with a clean, damp cloth. Refinish any scratches or abrasions with S&C touch-up finish and red-oxide primer, which are available in aerosol spray cans. See Figure 21. See S&C Specification Bulletin 681-31 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 all 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.

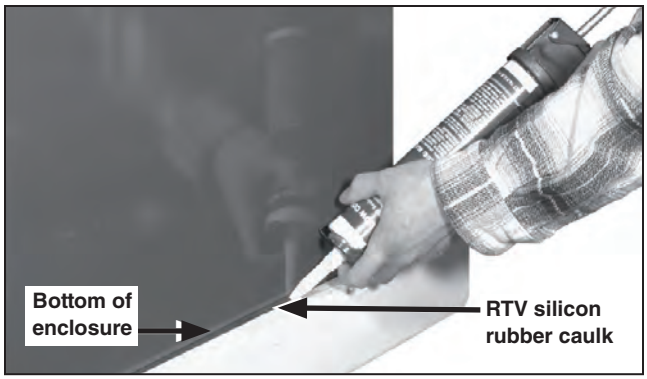



**Figure 19. Caulking around the bottom of the enclosure.**

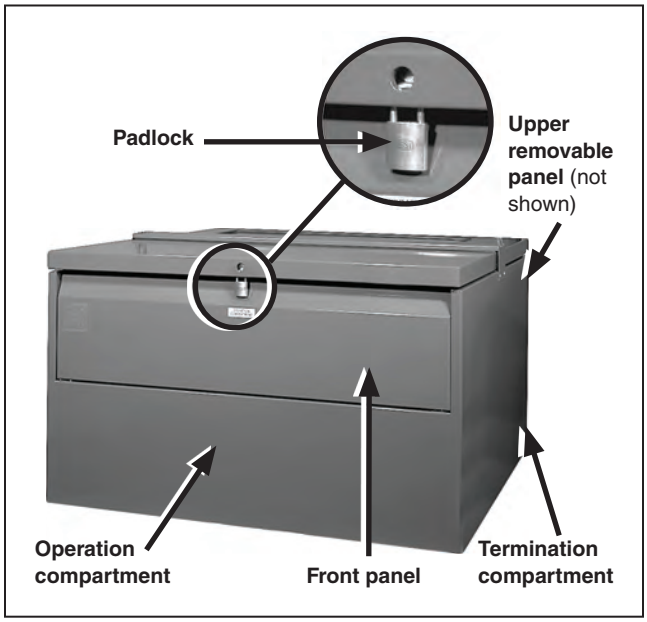



**Figure 20. The switchgear secured with a padlock.**




**Figure 21. S&C red-oxide primer and touch-up finish.**

## Tank Placement

Complete the following steps to place the tank for UnderCover and vault-mounted style Vista switchgear:

**STEP 1.** Remove any packing or foam from around the viewing window and check the gas-pressure gauge to make sure it is in the Green zone. Contact S&C Electric Company if the gas-pressure gauge is not in the Green zone. See the "Gas-Pressure Gauge" section on page 20 for more information.

**STEP 2.** Unbolt the tank from the skid, remove the switchgear from its crate, and lift the gear into place, observing the precautions given in the "Handling" section on page 8. See Figure 2 on page 8 and Figure 22.

**STEP 3.** Secure the switchgear in place in accordance with the pull box or wall brackets provided by the user.

## Cable Terminations

**⚠ DANGER**

Before energizing the switchgear, replace the shipping covers on all bushing and bushing wells with elbows or insulated protective caps.

**Failure to replace the shipping covers on all bushings and bushing wells with elbows or insulated protective caps can result in a flashover and serious personal injury or death.**

**⚠ CAUTION**

ALWAYS follow proper cable-installation practices. When installing cable that will be attached to the switchgear, provide a strain-relief segment to minimize the load on the bushings. Cables must be allowed to expand and flex without putting a significant load on the bushings. For a pit, either loop the cable in the pit or bring it into the pit horizontally and up to the gear at a 90° angle.

**Failure to follow these precautions can result in minor injury as well as damage to the bushings and bushing wells and subsequent leakage of insulating gas.**

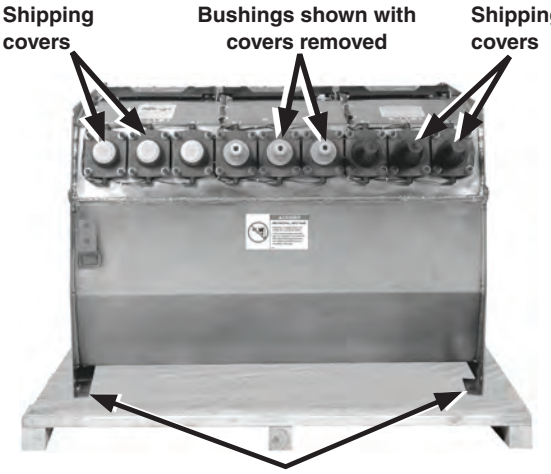



**Figure 22. A Vista switchgear tank bolted to a skid for shipment.**

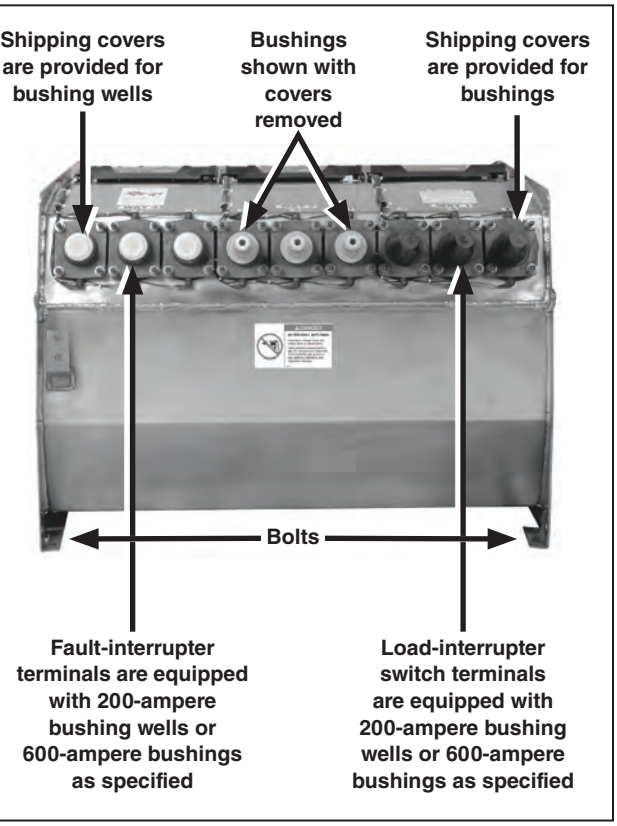



**Figure 23. A Vista switchgear tank showing appropriate shipping covers.**

Complete the following steps for terminating cables:

**STEP 1.** Remove the shipping covers from the bushings and bushing wells. See Figure 23 on page 18.

**STEP 2.** Terminate the cables with the elbows, following the elbow manufacturer's instructions. See Figure 23 on page 18.

## Grounding

Complete the following steps to properly ground UnderCover and vault-mounted style Vista switchgear:

**STEP 1.** Connect the cable concentric-neutral ground wires to the grounding system as appropriate.

**STEP 2.** Connect the ground pad of the tank to the system ground facility in accordance with the user's standard grounding practice. See Figure 25.

Use the equivalent of 4/0 copper (or cable sized in accordance with the user's standard practice) in either a single or multiple connection to realize the maximum momentary rating of the switchgear. For a multiple connection, cables smaller than 1/0 copper or equivalent should not be used.

## Fault Indicators

Fault indicators are to be furnished by the user and installed in accordance with the manufacturer's instructions.

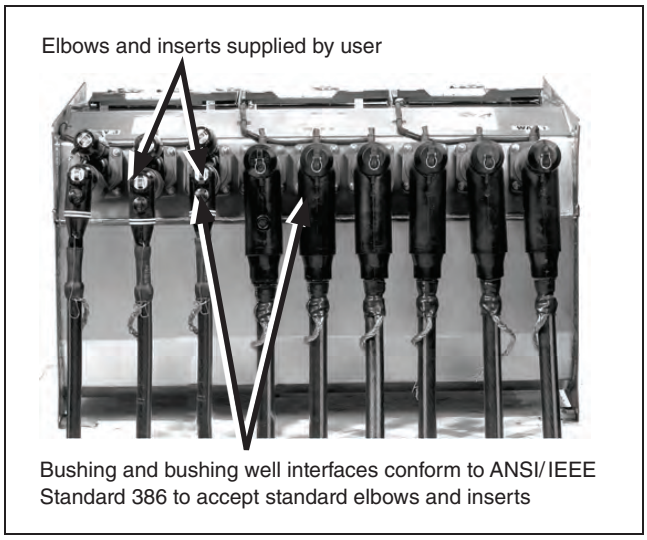



**Figure 24. A Vista switchgear tank shown with user-supplied cables and elbows.**

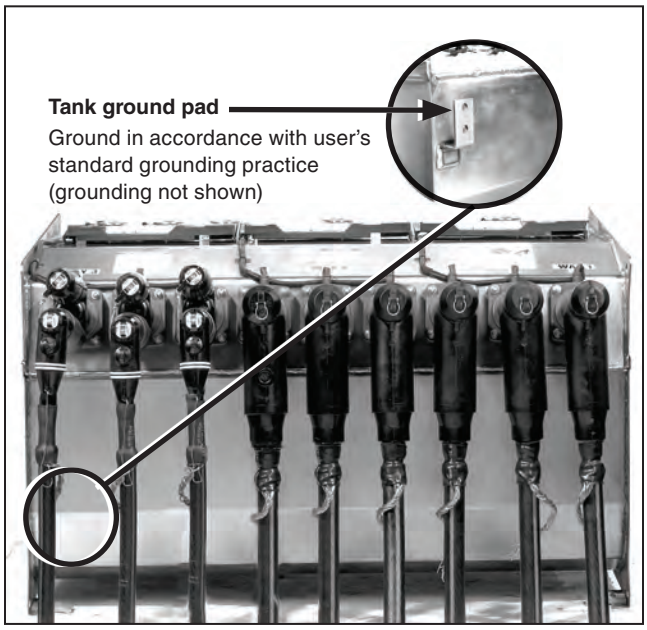



**Figure 25. The tank ground pad.**

## 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 Figure 26 and Figure 27, and Figure 28 on page 21.

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 $SF_6$ models:*** The unit should be evaluated to determine whether it needs to be refilled with $SF_6$ gas via the field-accessible fill port and repaired accordingly. Contact S&C for assistance.

Vista Green switchgear models ($CO_2$-mix) 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 in the field or has a defective pressure gauge. For $SF_6$ Vista switchgear with 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 ($CO_2$-mix) are hermetically sealed. The gas-fill port is not accessible in the field as standard. Contact S&C for assistance.

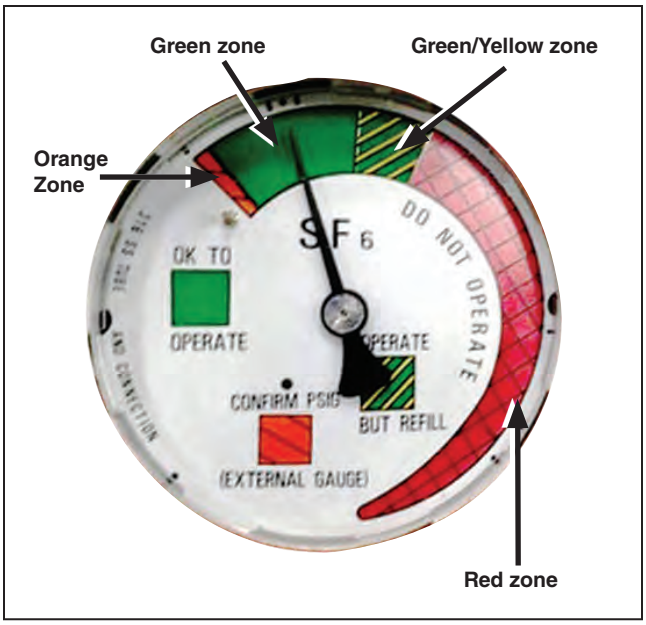



**Figure 26. The internal gas-pressure gauge for most Vista switchgear models.**

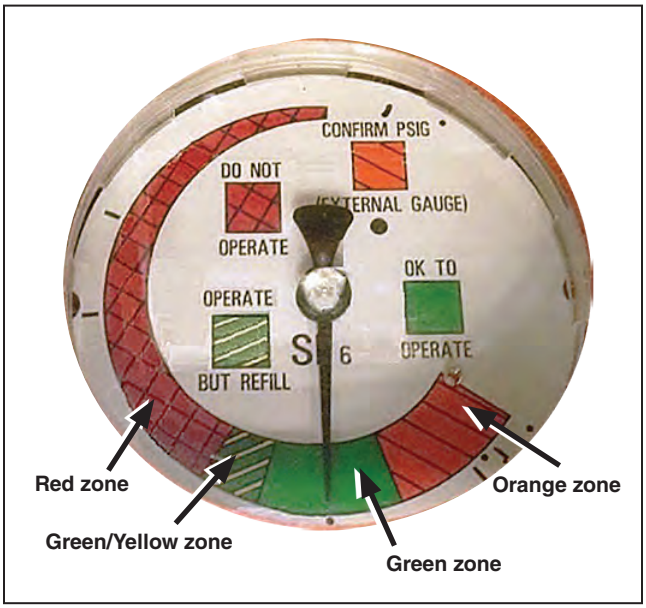



**Figure 27. The internal gas-pressure gauge for Vista switchgear models rated 15 kV, 12.5 kA sym. short circuit that have catalog numbers ending in "R1."**

## 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 SF6 units:*** If the gauge shows a sudden drop or increase in pressure, S&C recommends checking with an external gauge or waiting for ambient temperature conditions to stabilize to confirm the needle has returned to its normal position.

Vista Green switchgear models ($CO_2$-mix) are hermetically sealed. The gas-fill port is not accessible in the field as standard. Contact S&C for assistance.

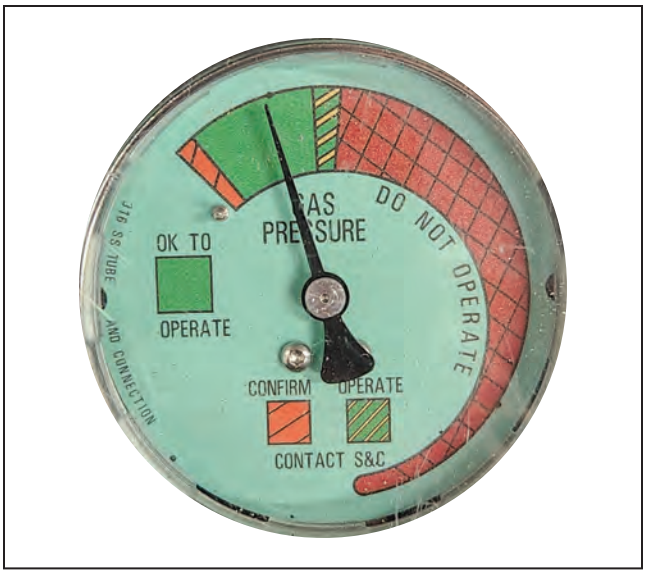



**Figure 28. The internal gas-pressure gauge for Vista Green switchgear models ($CO_2$-mix), "-GRN" catalog numbers.**

## 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 Underground Distribution Switchgear are given in Table 1 and in Table 2 on page 23. 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 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 bushings with an insulated cap or other appropriate cable termination capable of withstanding the test voltage.
3. Verify the insulating-gas pressure gauge is in the green zone.

## 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 like 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 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 voltage greater than the withstand capability of the switchgear can result in a flashover, injury, and equipment damage.**

Always verify the insulating-gas pressure gauge is in the green zone before proceeding with any testing.

**Table 1. Maximum Insulation Test Voltages of Vista Underground Distribution Switchgear**

| Vista Switchgear Rating, kV | | | Withstand Test Voltage, kV | |
|---|---|---|---|---|
| 50 Hertz | 60 Hertz | Impulse (BIL) | Power Frequency① | DC②③ |
| 12 | 15.5 | 95 | 27 | 42 |
| 24 | 27 | 125 | 40 | 62 |
| 36 | 38 | 150 | 50 | 82 |

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 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 DC withstand test values listed in the table are approximately equal to the AC peak test voltage.

**⚠ DANGER**

Do not exceed the test voltages given in Table 2. Exceeding the test voltages can cause a flashover of the isolating gap or phase-to-phase insulation of the switchgear. **This can lead to a power-frequency fault in the gear or the DC test source, and result in severe personal injury or death.**

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

Vista Underground Distribution 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 grounding with the grounding switch. The DC test voltages and DC cable thumping voltages should not exceed the voltages given in Table 2.

**Table 2. Maximum Cable Testing and Cable Thumping DC Withstand Voltages of Vista Underground Distribution Switchgear**

| Vista Switchgear Rating, kV | | | DC Cable Test Voltage, kV | DC Cable Thumping Voltage, kV① |
|---|---|---|---|---|
| 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 voltage doubling will occur at the open end of the cable, which is assumed to be a unit of Vista 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 VLF AC withstand capability of the switchgear may be reduced because of aging, damage, gas leakage, or electrical or mechanical wear. Therefore, the AC test voltage must be selected so 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.**

Always verify the insulating-gas pressure gauge is in the Green zone before proceeding with any testing.

**⚠ DANGER**

Do not exceed the test voltages given in Table 3 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 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 may result in injury or equipment damage.**

**⚠ WARNING**

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

**Failure to fully discharge the cable system and test equipment can result in serious damage to the cable system and test equipment.**

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 Vista Underground Distribution Switchgear to the AC test voltage when the cables are attached to the switchgear. S&C recommends that the Vista switchgear be completely de-energized and disconnected from all power sources when performing VLF cable testing. Before proceeding with the VLF cable testing, verify the Vista switchgear insulating-gas pressure gauge is in the green zone.

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. Then, the cable system must be grounded.

The VLF sinusoidal waveform test voltages applied to the Vista switchgear must not exceed the voltages listed in Table 3.

**Table 3. Low-Frequency Cable Testing**

| Vista Switchgear Very Low Frequency (.01- to 1-Hz) Sinusoidal Waveform Maximum Test Voltages①② | | | | |
|---|---|---|---|---|
| Vista Switchgear System Class, kV | Acceptance Test (phase to ground) | | Maintenance Test (phase to ground) | |
| | kV, RMS | kV, Peak | kV, RMS | kV, Peak |
| 15.5 | 21 | 30 | 16 | 22 |
| 27 | 32 | 45 | 24 | 34 |
| 38 | 44 | 62 | 33 | 47 |

① Per IEEE Std. 400.2. The most commonly used, commercially available, VLF test set frequency is 0.1 Hz.

② Do not exceed the test voltage recommended by the cable manufacturer.

## Fault-Interrupter Testing

When performing dielectrical tests on Vista 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.

## 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 Underground Distribution Switchgear before taking resistance measurements can 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.

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 29. 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. See Figure 30.

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 30.

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

- Less than 500 microohms
- Less than 600 microohms for tie switches

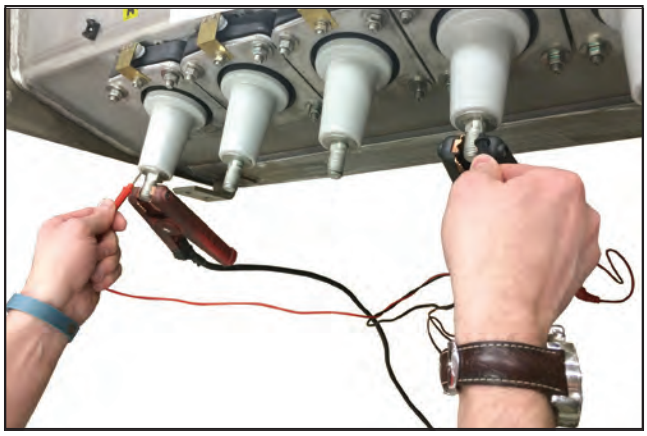


**Figure 29. Connecting the resistance measuring device.●**

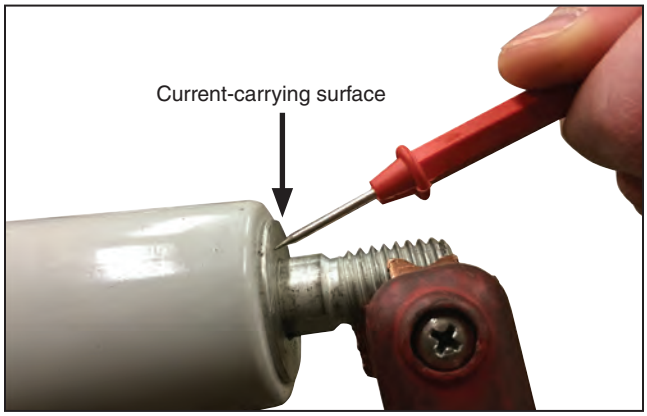



**Figure 30. Take the measurement from the flat current-carrying surface of the bushing.●**

● Resistance measurements shown without safety gloves. Please refer to your company's standards in regard to using hand PPE when taking resistance measurements.

## Pad-Mounted Style Manual Vista Switchgear

Vista switchgear tanks are designed to be either in a pad-mounted enclosure, vault, or UnderCover Style application. Pad-mounted manual Vista switchgear can be stored outdoors on its shipping skid until installation. The tank should remain as shipped, i.e. inside the pad-mount enclosure.

## UnderCover and Vault-Mounted Style Manual Vista Switchgear

Manual Vista switchgear tanks for UnderCover Style and vault-mounted applications are designed to be placed underground in a vault, basement, or indoor electrical room. Coverage for long-term storage of uninstalled units is necessary.

For long-term outdoor storage of UnderCover and Vault-style tanks, an ultraviolet (UV)-protection canopy is required to protect cabling and other UV-sensitive components to prevent unit damage. Failure to provide adequate UV-protection may result in unit damage that is not covered by the warranty.

S&C offers a UV-protection canopy for Vista switchgear tanks in two sizes. See Table 4.

**Table 4. Vista Switchgear UV-Protection Canopies**

| Product | Canopy Size | Catalog Number |
|---|---|---|
| UV protection canopy | Vista switchgear (4-way—6 way) | CUA-9514-1 |
| | Vista switchgear (2-way—4 way) | CUA-9514-2 |