

Installation, Operation, and Maintenance

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Type XL



Type NL



Qualified Persons

WARNING

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

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

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

Read this Instruction Sheet

Read this instruction sheet thoroughly and carefully before installing or operating your S&C Type XL or S&C Type NL Regulator Bypass Switch. Familiarize yourself with “Safety Information” on page 4. The latest version of this publication is available online in PDF format at sandc.com/Support/Product-Literature.asp

Retain this Instruction Sheet

This instruction sheet is a permanent part of your S&C Type XL or S&C Type NL Regulator Bypass Switch. Designate a location where you can easily retrieve and refer to this publication.

Proper Application

Type XL and NL Regulator Bypass Switches are station-class devices used to bypass and isolate voltage regulators for maintenance. They can also be applied to bypass and isolate devices such as current transformers of primary metering equipment.

Type NL Regulator Bypass Switches perform the same functions as the Type XL Regulator Bypass Switches, except the sequencing of operations is left to the operator. Type NL Regulator Bypass Switches are used in applications where a 1200-ampere continuous rating is required or where it is desired to bypass the voltage while leaving its shunt winding energized (bypass blade closed, disconnect blade open) so that mechanical and electrical testing can be carried out.

Refer to the documentation supplied with your voltage regulator or other device before installing your S&C Regulator Bypass Switch. Contact the manufacturer of your voltage regulator or other device if you have any questions concerning the compatibility of your S&C Regulator Bypass Switch with non-S&C-supplied equipment or contact your nearest S&C Sales Office.

CAUTION

The S&C Type XL and Type NL Regulator Bypass Switches described in this publication must be selected for a specific application that is within the ratings furnished for this equipment. The ratings for each bypass switch are listed on a ratings label found on the base of the bypass switch. Ratings and dimensional drawings for each regulator bypass switch are also in S&C Specification Bulletin 841-31 available on sandc.com.

Warranty


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

Understanding
Safety-Alert
Messages


There are several types of safety-alert messages that may appear throughout this instruction sheet as well as on labels and tags attached to the S&C Regulator Bypass Switch. Familiarize yourself with these types of messages and the importance of the various signal words, as explained below.

 **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 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, or call S&C Headquarters at (773) 338-1000, Monday through Friday between 8:30 AM and 5:00 PM Central Standard Time. (In Canada, call S&C Electric Canada Ltd. at (416) 249-9171, Monday through Friday between 8:00 AM and 5:00 PM Eastern Standard Time.)

NOTICE

Read this instruction sheet thoroughly and carefully before installing or operating your S&C Regulator Bypass Switch.



Replacement
Instructions and
Labels

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.

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 that all shipping skids, crates, and containers listed thereon 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

Remove the regulator bypass switch from the shipping carton or crate, taking care not to lift it by the blades, live parts, or pull-ring.

Installation

Installing the Regulator Bypass Switch

Before Starting

NOTICE

This instruction sheet ONLY describes the procedure for installing, operating, and maintaining the S&C Regulator Bypass Switch. Refer to the documentation supplied with your voltage regulator or other device before installing your S&C Regulator Bypass Switch.

Step 1

Hoist the regulator bypass switch and bolt it into position on the pole or supporting structure. The bypass switch is designed to be installed in-line with the voltage regulator in the positions shown in Figures 1 and 2, with the pull-ring at the top. If necessary, shim the base to eliminate any distortion caused by irregularities in the supporting structure.

When installing, observe the correct electrical and operational clearance in front of the bypass switch for your application.

Step 2

Verify the presence of the contact lubricant applied at the factory to both the jaw and hinge blade contact surfaces—and that this lubricant is still free of contaminants. If necessary, clean the contact surfaces with a nontoxic, nonflammable solvent and apply a fresh coating of lubricant (S&C Part Number 9999-043, Shell Gadus® S2 U1000 2 or equivalent).

Step 3

Make the electrical connection between the source terminal of the regulator bypass switch and the source side of the voltage regulator and the load terminal of the regulator bypass switch and the load-side of the voltage regulator. See Figures 1 and 2.

If you are using aluminum conductors, be sure to wire-brush them and apply a coating of oxidation inhibitor (No-Ox-Id “A” Special® or equivalent) before inserting them into the connectors.

Step 4

For Type NL Regulator Bypass Switches:

Before placing the Type NL Regulator Bypass Switch into service, open the bypass blade. The bypass blade should remain in the open position when the voltage regulator is energized.

Remember to return the bypass blade of the Type NL Regulator Bypass Switch to the open position after performing the “Checking Operation” procedure detailed in Step 5.

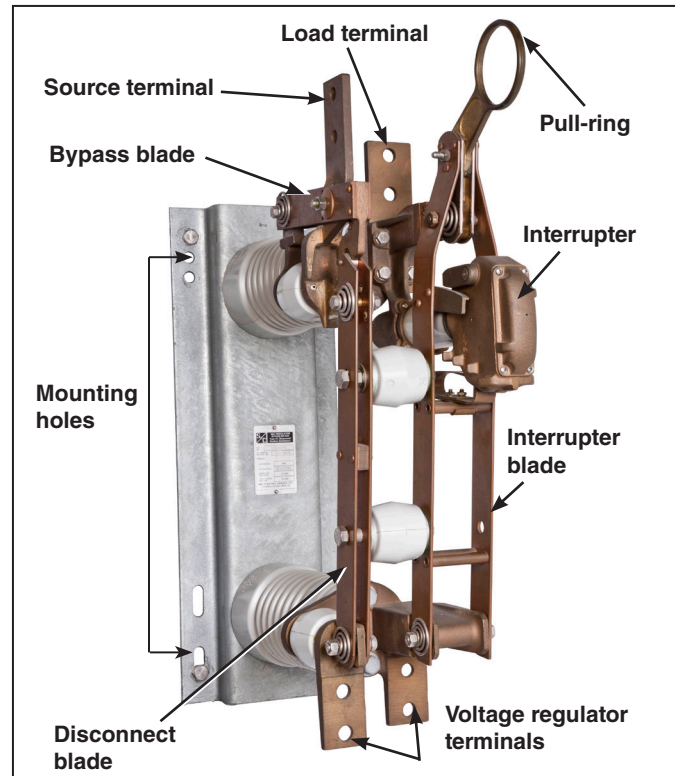


Figure 1. Type XL Regulator Bypass Switch.

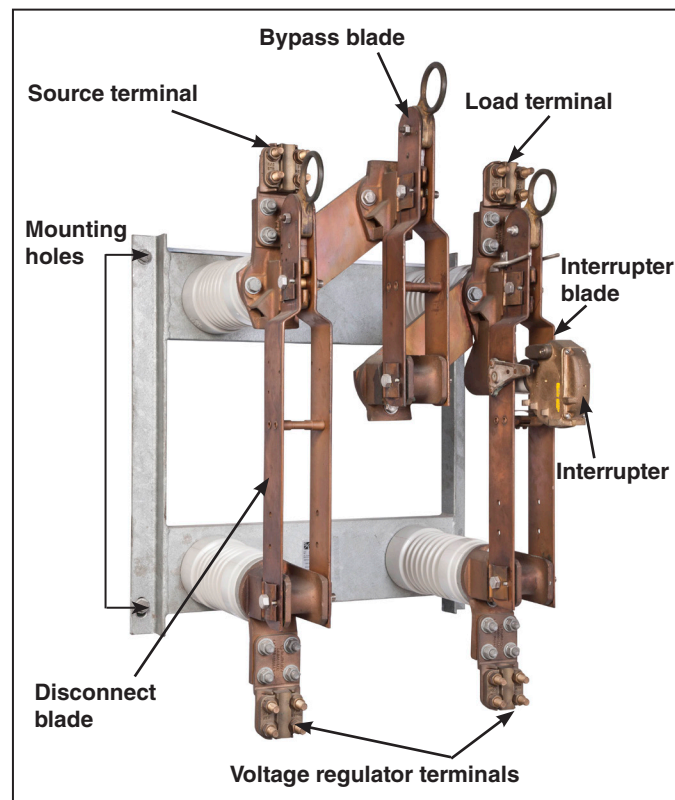


Figure 2. Type NL Regulator Bypass Switch.

Step 5

Checking Operation

Before placing the bypass switch into service, check the interrupter to verify that critical blade-to-interrupter clearances are as shown in Table 1 on page 8.

- (a) When the interrupter blade is in the closed position, the main contacts should be fully closed. On Type NL Switch Blades, the blade will rest against the stop. See Figure 3a. On Type XL Switch Blades, the stationary contact will protrude approximately $\frac{1}{4}$ inch from the blade contacts. See Figure 3b.
- (b) The interrupter should be centered between the two halves of the interrupter blade, with equal clearance on either side. See Figure 4a and 4b.
- (c) Check the gap between the interrupter housing and the shunt contact on the blade assembly. (See Table 1, Dimension A on page 8.)

NOTICE

There should be a gap between the interrupter housing and the shunt contact. Without a gap between the shunt contact and the interrupter housing contact in the closed position, it is possible for load current to continuously flow through the interrupter. The interrupter is designed for intermittent duty **ONLY**. Energizing a switch without proper clearance will overheat the interrupter causing the switch to malfunction.

- (d) Check the gap between the blade-closing lever and the interrupter-closing cam. (See Table 1, Dimension B on page 8.)
- (e) Open the switch so the shunt contact is engaged with the **interrupter housing contact**. Check the distance between the **opening cam** and **opening lever**. (See Table 1, Dimension C on page 8.)
- (f) From the closed position, slowly open the interrupter switch blade until the blade is just about to separate from the stationary contact. At this point, the blade shunt contact should touch the interrupter housing contact. See Figures 5a and 5b on page 9.

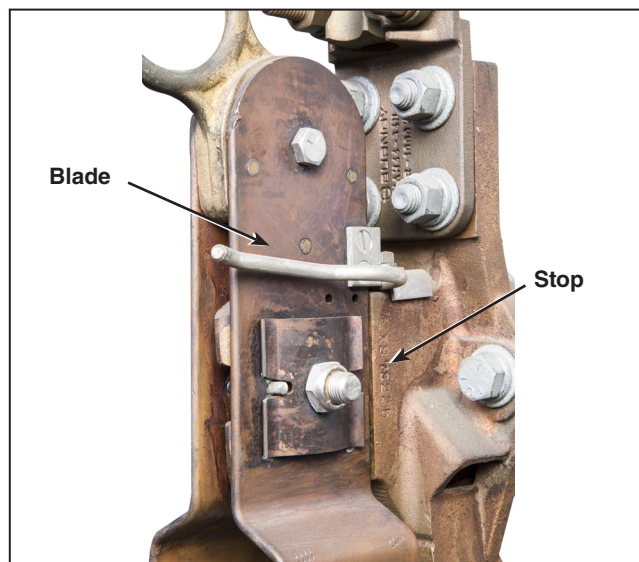


Figure 3a. Type NL Regulator Bypass Switch. Check that each blade is against the stop. (Type NL Interrupter Blade shown, Disconnect and Bypass Blades similar.)

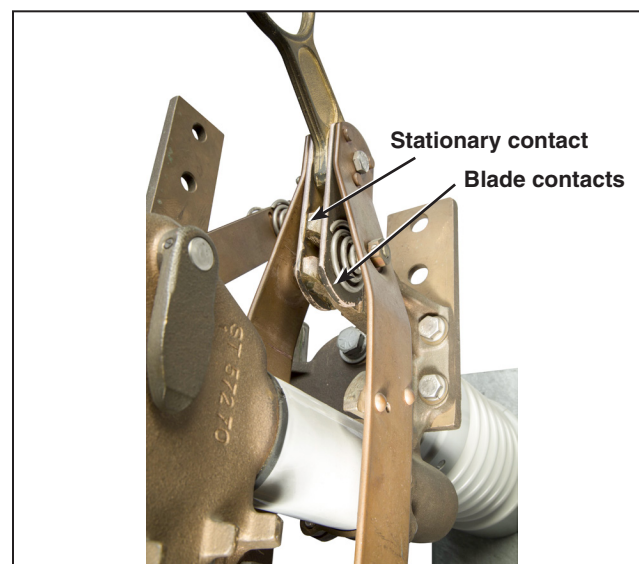


Figure 3b. Type XL Regulator Bypass Switch. Check that the stationary contacts are visible through the blade contacts. The stationary contact will protrude approximately $\frac{1}{4}$ inch from the blade contacts.

Installation

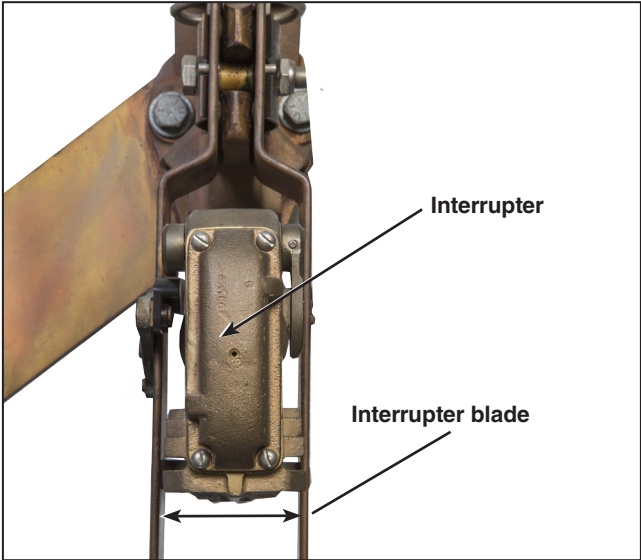


Figure 4a. Type NL Interrupter Blade. Check to make sure the interrupter is centered between both sides of the interrupter blade.

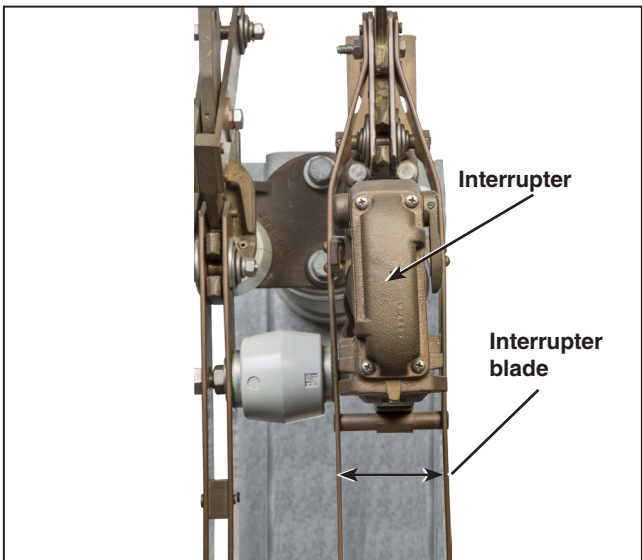


Figure 4b. Type XL Interrupter Blade. Check to make sure the interrupter is centered between both sides of the interrupter blade.

TABLE 1—INTERRUPTER INSPECTIONS

Model	Voltage, kV	Dimension A	Dimension B	Dimension C
Type XL Regulator Bypass Switch	14.4	1/8-inch	3/16-inch (max.)	3/16-inch (max.)
	25	1/8-inch	3/16-inch (max.)	3/16-inch (max.)
Type NL Regulator Bypass Switch	14.4	3/16-inch	3/16-inch (max.)	1/8-inch (max.)
	25	3/16-inch	3/16-inch (max.)	1/8-inch (max.)

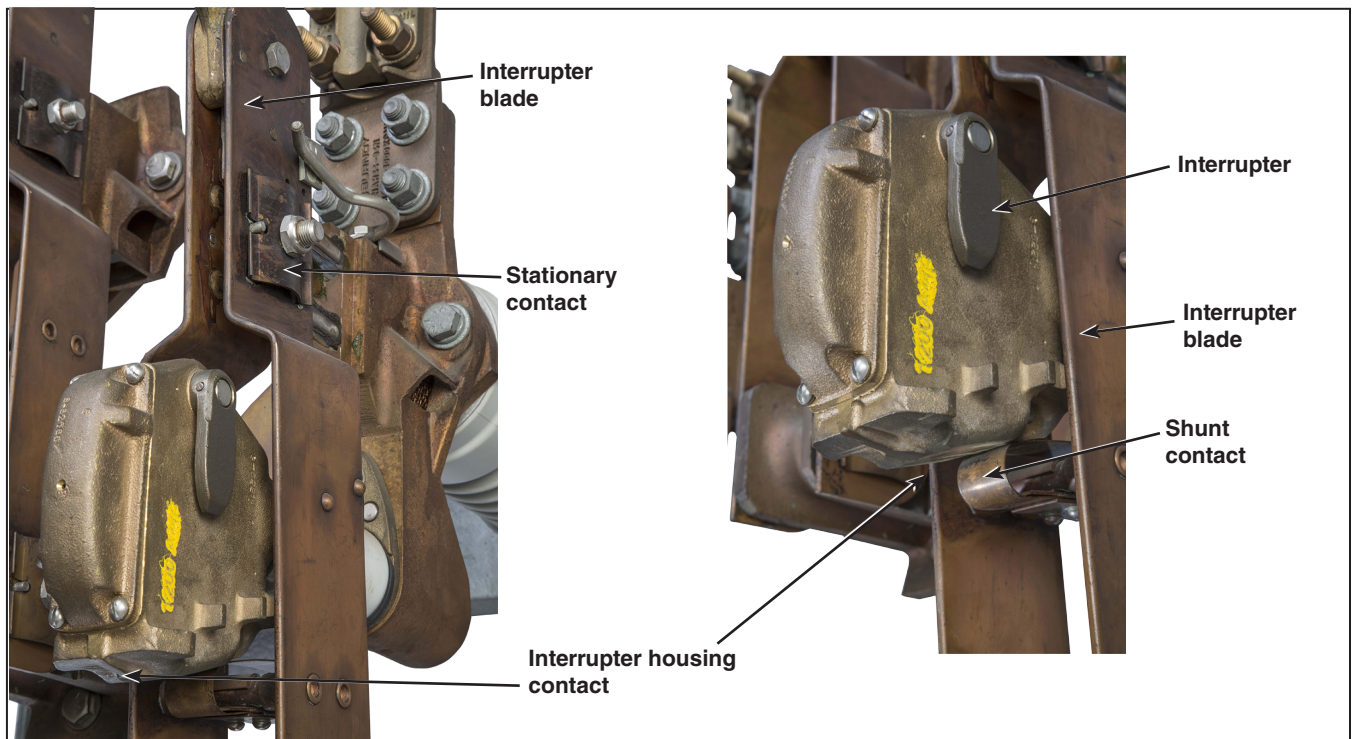


Figure 5a. Type NL Bypass Switch. Check that the shunt contact is touching the interrupter housing contact BEFORE the blade separates from the stationary contact.

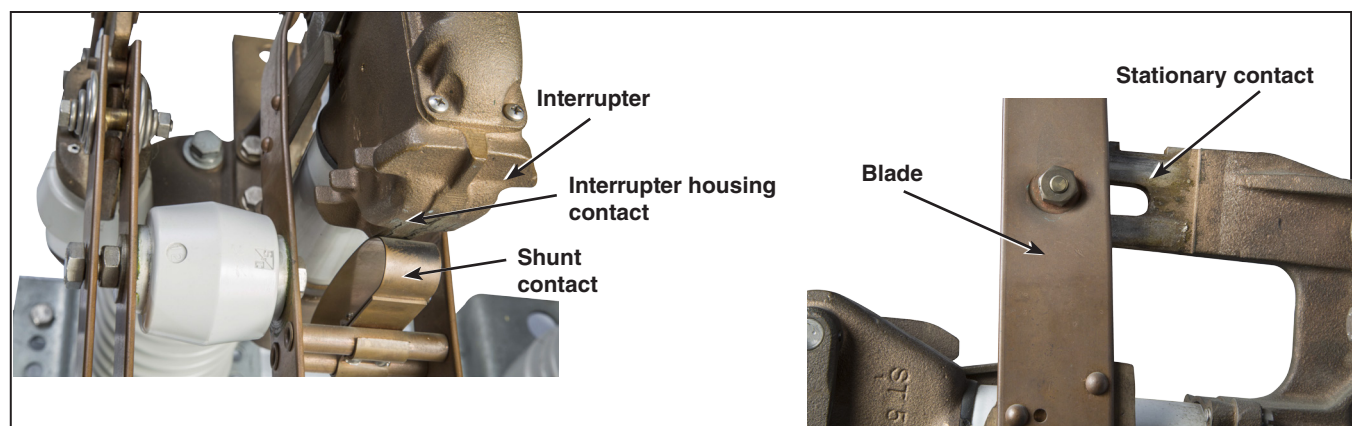


Figure 5b. Type XL Bypass Switch. Check that the shunt contact is touching the interrupter housing contact BEFORE the blade separates from the stationary contact.

NOTICE

Open and move the voltage regulator tap changers to the neutral position before operating the regulator bypass switch.

Operating the regulator bypass switch before opening and moving the tap changers to the neutral position may cause a short circuit in the voltage regulator's series winding.

XL Switch Operation

Type XL Regulator Bypass Switches provide built-in mechanical interlocking and sequencing. One pull-ring is used to open the switch. During the opening stroke, the bypass blade closes first, bypassing the regulator without interrupting service to the load. Then the disconnect blade opens the regulator series winding. Finally, the interrupter blade opens, interrupting the shunt-winding magnetizing current and isolating the regulator from the line.

Before Operating

To open and close the bypass switch using the hookstick ring, use a conventional insulated hookstick or S&C Universal Pole and Pole Extension (if required) fitted with a heavy-duty hook-tool such as the S&C Substation Prong or equivalent.

Step 6

To Open:

Using a vigorous downward force, pull the hookstick ring until the interrupter blade is in the fully open position, 90 degrees from the closed position. Be prepared to apply additional force when the interrupter blade engages with the interrupter. Support the interrupter blade with the hookstick through its full travel. The operation is automatically sequenced as shown in Figure 7 on page 12.

To Close:

To close the bypass switch and restore the regulator to service, engage the hookstick ring with the substation prong and push the interrupter blade firmly back into the jaw contact.

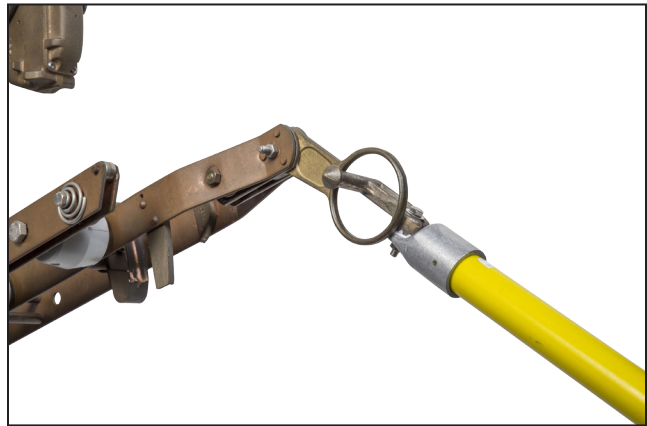


Figure 6. Use a conventional insulated hookstick fitted with a heavy-duty hook-tool such as the S&C Substation Prong.

NL Switch Operation

The Type NL Regulator Bypass Switch is *manually sequenced*. The center “bypass blade” is in the normally open position while the voltage regulator is energized. The voltage regulator is bypassed by operating the bypass, disconnect, and interrupter blades in sequential order. See Figure 8 on page 13.

Before Operating

To open and close the bypass switch hookstick rings, use a conventional insulated hookstick or S&C Universal Pole and Pole Extension (if required) fitted with a heavy-duty hook-tool such as the S&C Substation Prong or equivalent.

Step 7

To Open:

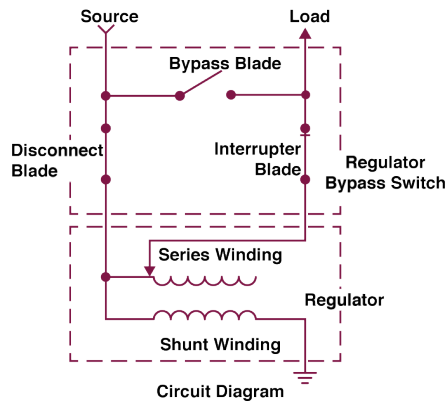
- (a) Engage the hookstick-mounted substation prong with the hookstick ring of the **bypass blade**. Using a vigorous upward push, close the **bypass blade** into the **bypass jaw contacts**. This prevents interruption of service to the load.
- (b) Using a vigorous downward force, pull the hookstick ring on the **disconnect blade** until the **disconnect blade** is fully-open. This opens the voltage regulator series winding.
- (c) Using a vigorous downward force, pull the hookstick ring of the interrupter blade down until the interrupter blade is fully-open. Be prepared to apply additional force when the interrupter blade engages the interrupter. Support the interrupter blade with the hookstick through its full travel. This will interrupt the shunt-winding magnetizing current, isolating the regulator from the line.

To Close:

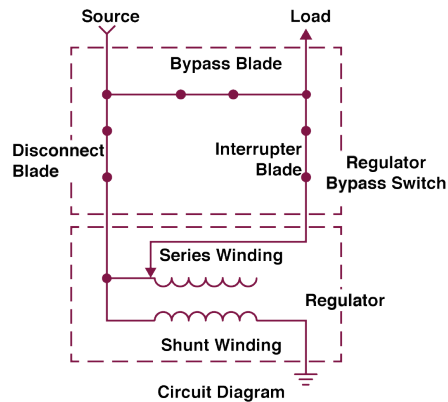
- (a) Engage the hookstick-mounted substation prong with the hookstick ring on the **interrupter blade**. Using a vigorous upward push, close the **interrupter blade** into the **load-side jaw contact**.
- (b) Engage the hookstick-mounted substation prong with the hookstick ring on the **disconnect blade**. Using a vigorous upward push, close the disconnect blade into the **source-side jaw contact**.
- (c) Using a vigorous downward force, pull the hookstick ring on the bypass blade until the bypass blade is fully-open, putting the voltage regulator back into service.

For testing purposes, the voltage regulator may be bypassed with its shunt winding energized, by closing the **bypass blade** and then opening the **disconnect blade**.

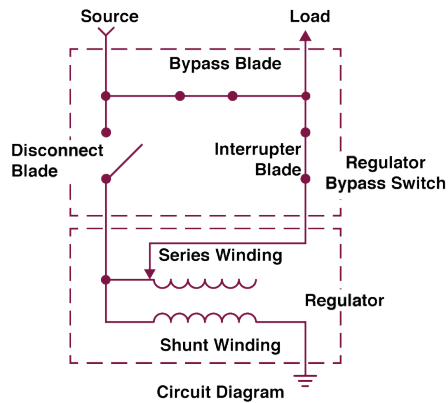
Operation



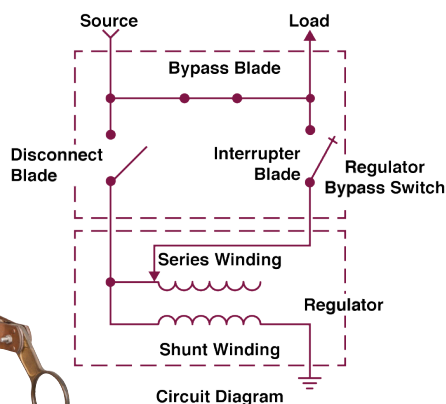
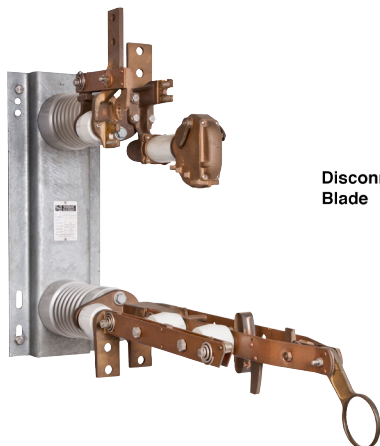
Switch closed. Voltage regulator is energized. Bypass blade is open; disconnect blade and interrupter blade are closed.



Switch in early stage of opening stroke. Bypass blade has closed, making a direct connection between the source and load. Disconnect blade and interrupter blade are still closed.



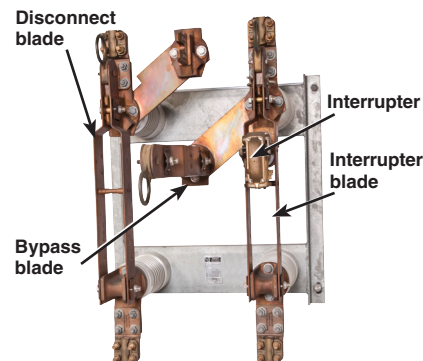
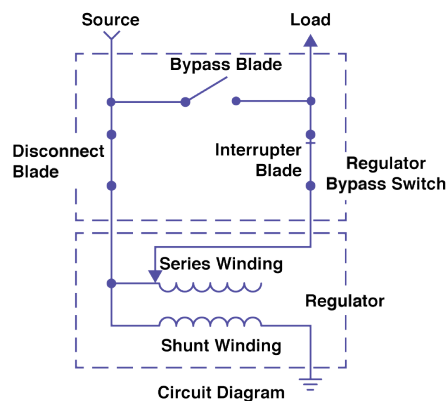
Switch in later stage of opening stroke. Disconnect blade has opened, but voltage-regulator shunt winding is still energized through the interrupter blade.



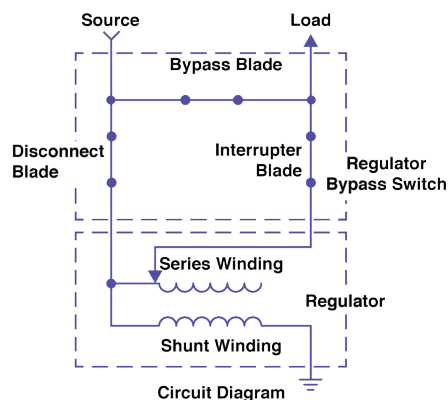
Switch fully open. Voltage-regulator magnetizing-current interruption has taken place within the interrupter with no external arc or flame. Voltage regulator is de-energized and bypassed.

Figure 7. Sequence of operation of Type XL Regulator Bypass Switches.

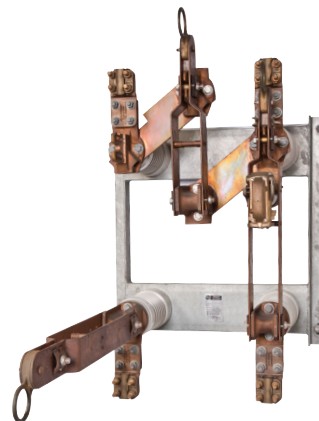
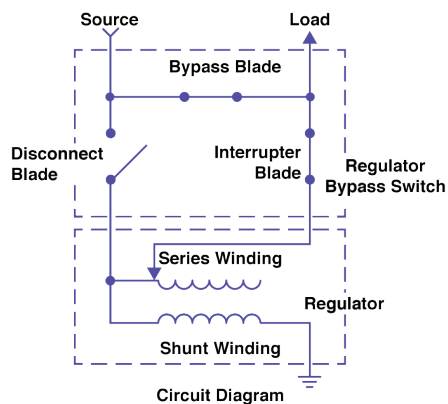
When the voltage regulator is energized the bypass blade is open; disconnect blade and interrupter blade are closed.



First step to isolate regulator: Bypass blade is closed. Voltage-regulator series winding is now shunted by bypass blade. Disconnect blade and interrupter blade remain in closed position.



Second step to isolate regulator: Disconnect blade is opened-disconnecting the voltage-regulator series winding. Bypass blade is still closed and voltage-regulator shunt winding remains energized through the interrupter blade.



Third step to isolate regulator: Interrupter blade is opened and voltage-regulator magnetizing current is interrupted inside the interrupter, with no external arc or flame. Bypass blade is still closed; disconnect blade is still open.

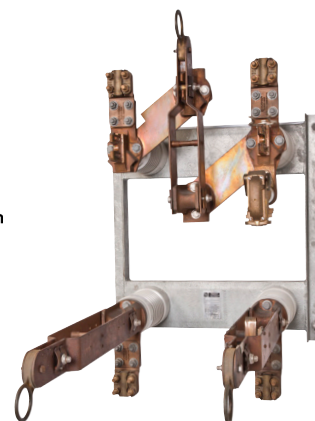
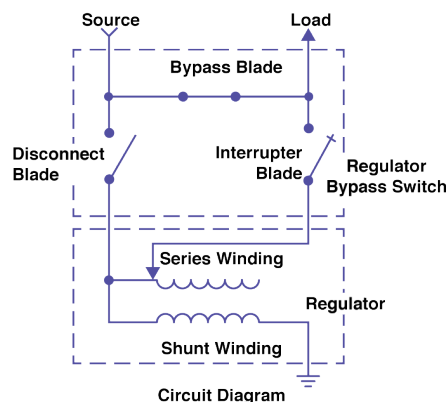


Figure 8. Sequence of operation of Type NL Regulator Bypass Switches.

Maintenance

The S&C Type XL and Type NL Regulator Bypass Switches are designed to be low-maintenance devices. S&C Electric Company recommends inspecting the regulator bypass switch during the voltage regulator's normal maintenance cycle. Frequent operation, humidity, pollution, emergency overloading of the line, and lightning strikes may necessitate more frequent inspection.

Tools Required:

- 6-inch metal scale
- $\frac{7}{8}$ -inch hex key (Type XL Interrupter Replacement)
- $\frac{3}{4}$ -inch box wrench (Type NL Interrupter Replacement)

Optional:

- Contact lubricant, Shell Gadus® S2 1000U 2 (S&C Part Number 9999-043)
- Steel wool (0#) or fine sandpaper (100 or 120)
- Wire brush (terminal pad prep)

Inspection

S&C recommends performing a basic visual and operational inspection of the switch before cleaning, lubrication, or interrupter replacement.

Step 8

Visual Inspection:

Start with the bypass switch in the fully closed position.

- Wildlife or Debris.** Check the bypass switch and associated voltage regulator for wildlife nests, tree limbs, or debris that could interfere with the dielectric clearance of the switch. Clear away any debris and clean the switch if necessary.
- Mounting Structure.** Check that the mounting structure has not warped (if wooden), settled, or tilted, and that the structure is in overall good condition. Check any mounting bolts, through-bolts, or lag screws used to secure the bypass switch to the structure to make sure they are secure and in good condition.
- Condition of Bases, Insulators, and Live Parts.** Check the insulators, live parts, and base for signs of tracking, flashover, contamination, arc damage, and soot. Also check that the shunt contact is not touching the interrupter housing contact. See Figure 9. If the interrupter housing has been in contact with the blade shunt contact while the interrupter blade has been closed and energized, the interrupter should be replaced.

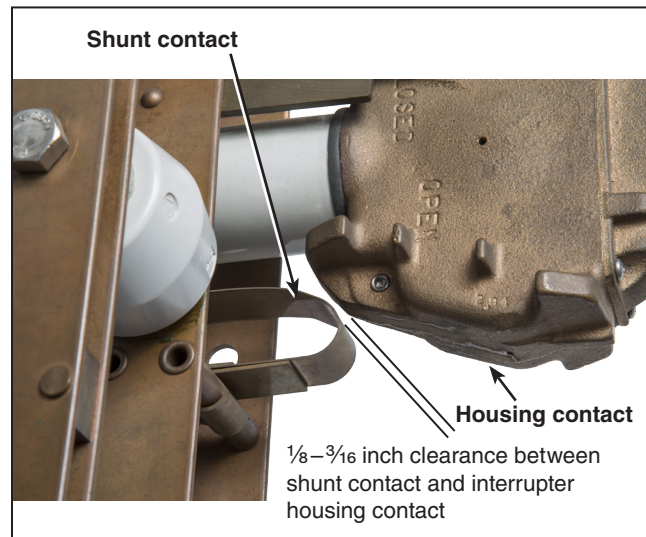


Figure 9. Check to make sure the blade shunt contact is not touching the interrupter housing. Replace the interrupter if the blade shunt contact is touching the interrupter housing.

Step 9

Operation Inspection:

DANGER

Operational Inspection of the regulator bypass switch should **ONLY** be performed when the regulator bypass switch is de-energized and grounded at both terminals.

Follow all applicable safety procedures. Failure to do so may lead to injury or death.

Open and close the bypass switch several times. Check that the operation is smooth through the full travel of the switch blades, and that the blade(s) open to 90 degrees, and seat fully against the closed stop when closed. The blade shunt contact should make firm contact with the interrupter housing contact when closed.

Follow the “Checking Operation” procedure in Step 5 starting on page 7 for a more detailed operational check.

Cleaning

NOTICE

DO NOT power wash the interrupter. Power washing the interrupter may cause excessive water ingress into the interrupter housing.

Step 10

The bypass switch may be power washed using water or a non-abrasive dry cleaning method. **DO NOT** power wash the interrupter. Direct the spray away from the interrupter concentrating on the blade(s), blade contacts, and hinges.

Make sure to operate the switch after using a dry cleaning method to thoroughly dislodge any particles of the cleaning medium that may have lodged in the contacts. Re-grease the contacts after power washing. See Step 11 for instructions on greasing the contacts.

Lubrication

Step 11

The contacts should be prepared with the blades in the open position before applying lubricant. See Figure 10.

- (a) Clean off the old grease with a clean, dry cloth. Remove oxidation by lightly polishing the contacts with steel wool or fine grit sandpaper, and wipe excess grit off with a dry cloth.
- (b) Apply a light coating of non-sulfur-containing contact lubricant such as Shell Gadus S2 1000U 2 or equivalent.

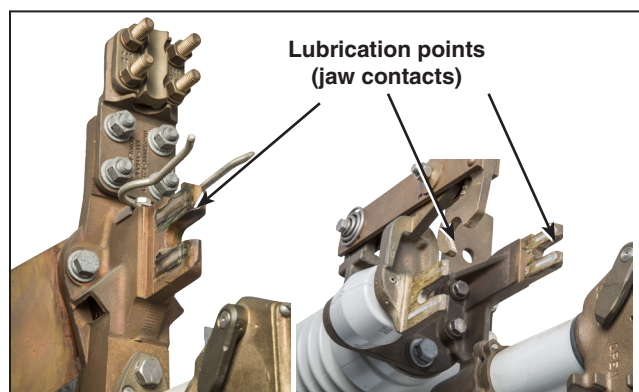


Figure 10. Clean off old grease with a clean cloth. Polish the contact if necessary. Apply a light coating of Shell Gadus S2 1000U 2 or equivalent.

Step 12

Interrupter Replacement

DANGER

Isolate the bypass switch at the load and line-side terminals and test for voltage. After the switch has been completely isolated, ground both sides of the switch according to standard utility practice.

Failure to do so will result in severe injury or death.

- (a) Open the switch.
- (b) Remove the existing interrupter. Discard the old hardware.
- (c) Make sure the interrupter is in the open position by pulling the opening lever away from the tube of the interrupter. See Figure 11.
- (d) Install the replacement interrupter using the bolts and lockwashers furnished.
 - Type XL Interrupters use $\frac{1}{4}$ -20 \times $\frac{7}{8}$ -inch button head screws and lockwashers.
 - Type NL Interrupter use $\frac{1}{2}$ -13 \times $\frac{7}{8}$ -inch hex-head cap screws and lockwashers.
- (e) While opening, verify that the blade contact and stationary contact are still engaged when the blade shunt contact first touches the interrupter housing contact. See Figures 5a and 5b on page 9.
- (f) Slowly close and open the interrupter blade several times and verify that the dimensions shown in the “Checking Operation” section starting on page 7 have been achieved.

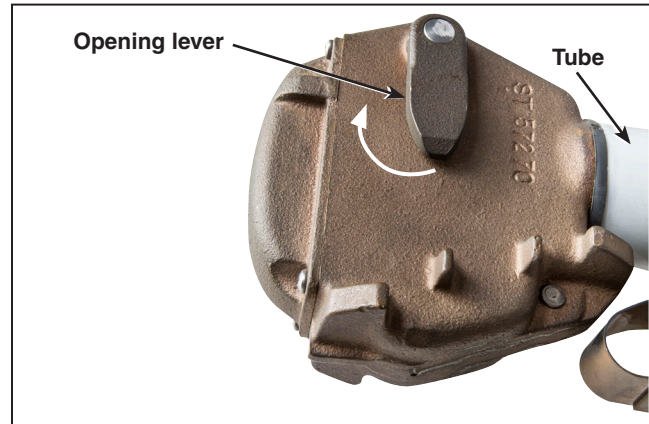


Figure 11. Pull the opening lever away from the tube of the interrupter to place it in the OPEN position.