NOVA™ STS-15, NOVA™ STS-27, and NOVA™ STS-38 Single-Tank, Triple-Single, Electronically Controlled Recloser Installation and Operation Instructions

Powering Business Worldwide

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Contents

Safety for life

Eaton meets or exceeds all applicable industry standards relating to product safety in its Cooper Power™ series products. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Eaton employees involved in product design, manufacture, marketing, and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high voltage lines and equipment, and support our "Safety For Life" mission.

Safety information

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians who are familiar with this equipment should install, operate, and service it.

A competent technician has these qualifications:

- Is thoroughly familiar with these instructions.
- Is trained in industry-accepted high and low-voltage safe operating practices and procedures.
- Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.
- Is trained in the care and use of protective equipment such as arc flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, hotstick, etc.

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in equipment damage only.

Safety instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

DANGER

Hazardous voltage. Contact with hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment. G103.3

WARNING

Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage. G101.0

WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury and equipment damage. G102.1

WARNING

Power distribution and transmission equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install or maintain power distribution and transmission equipment can result in death, severe personal injury, and equipment damage. G122.3

Product information

Introduction

Service Information MN280046EN provides installation, operation, and service instructions for Eaton's Cooper Power series NOVA™ STS single-tank, triple-single electronically controlled recloser.

Read this manual first

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment.

This recloser is used in conjunction with a Form 6 Triple-Single recloser control. Refer to *Service Information S280-70-7 Form 6 Triple-Single, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions*.

Additional information

These instructions can not cover all details or variations in the equipment, procedures, or processes described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact your Eaton's Cooper Power series product representative.

Acceptance and initial inspection

Each recloser is completely assembled, tested, and inspected at the factory. It is in good condition when accepted by the carrier for shipment. Upon receipt, inspect the shipping container for signs of damage. Unpack the recloser and inspect it thoroughly for damage incurred during shipment. If damage is discovered, file a claim with the carrier immediately.

Handling and storage

Be careful during handling and storage of the recloser to minimize the possibility of damage. If the recloser is to be stored for any length of time prior to installation, provide a clean, dry storage area.

Eaton recommends transporting the Cooper Power series NOVA reclosers in the closed position to maximize the operational performance of the unit.

Standards

NOVA STS single-tank, triple-single, electronically controlled reclosers are designed and tested in accordance with:

- IEEE Std C37.60™–2012 standard
- ANSI® C37.85–2002

Quality standards

ISO 9001 Certified Quality Management System

Description

The NOVA STS single-tank, triple-single recloser consists of three single-phase reclosers in a single tank. Each recloser consists of an interrupting module, with an embedded current transformer, and mechanism mounted on an aluminum or stainless steel tank. The tank is suitable for pole or substation mounting. The interrupter modules utilize outdoor cycloaliphatic-epoxy-encapsulated vacuum interrupters.

The three single-phase reclosers that make up the NOVA STS recloser are controlled by a single microprocessor-based recloser control that can be programmed for three operating modes.

- Single-phase trip, Single-phase lockout
- Single-phase trip, Three-phase lockout
- Three-phase trip, Three-phase lockout

Refer to *Service Information S280-70-7 Form 6 Triple-Single, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* for a description of the control operation.

Ratings and specifications

Check recloser ratings prior to installation

The recloser must be applied within its specified ratings. Check data plate ratings and compare with the system characteristics at the point of application prior to installation. Tables 1-5 list the ratings and specifications for the NOVA STS single-tank, triple-single recloser.

Table 1. Voltage ratings

Description	15 kV	15 kV	27 kV	27 kV	38 kV
Maximum voltage	15.5 kV	15.5 kV	27.0 kV	27.0 kV	38.0 kV
Rated basic impulse level	110.0 kV	125.0 kV	125.0 kV	150.0 kV	170.0 kV
Radio noise limit (µv)	100 @ 9.4 kV	100 @ 9.4 kV	100 @ 16.4 kV	100 @ 16.4 kV	100 @ 23.0 kV
Power frequency withstand, dry	50 kV	50 kV	60 kV	60 kV	70 kV
Power frequency withstand, wet	45 kV	45 kV	50 kV	50 kV	60 kV

Table 2. Current ratings

Description	15 kV	15 kV	27 kV	27 kV	38 kV
Rated Continuous Current	630 A*	630 A*	630 A*	630 A*	630 A*
Short Circuit Current, Symmetrical	12.5 kA**	12.5 kA**	12.5 kA**	12.5 kA**	12.5 kA
Making Current, Asymmetrical Peak	32.0 kA	32.0 kA	32.0 kA	32.0 kA	32.0 kA
Making Current, Asymmetrical rms	20.0 kA	20.0 kA	20.0 kA	20.0 kA	20.0 kA

* 800 A accessory is also available.
** 16.0 kA option is also available. (Making current is 41.0 kA Asymmetrical Peak and 25.0 kA Asymmetrical rms.)

Table 3. Mechanical ratings

Description	15 kV	15 kV	27 kV	27 kV	38 kV
Min. Mechanical/Electrical Operations Without Maintenance (C-O)	10,000	10,000	10,000	10,000	10,000
Mass (Weight) - kg (lbs)	130 (288)	133 (294)	133 (294)	138 (305)	138 (305)
Mass (Weight) with Pole Mounting Hanger	183 (403)	186 (409)	186 (409)	191 (420)	191 (420)

Table 4. Duty cycle

Percent maximum circuit interrupting rating	Minimum X/R ratio	Number of unit operations at 12.5 kA	Number of unit operations at 16.0 kA
15-20	4	88	44
45-55	8	112	56
90-100	17*	32	16
		Total 232	**Total 116**

*Value shown for 60 Hz.

Table 5. Power requirements

Voltage	Normal current Heaters	Duration	Recommended power Heaters
120 Vac	0.45 A	Continuous	54 VA
240 Vac	0.24 A	Continuous	57.6 VA

Recloser dimensions

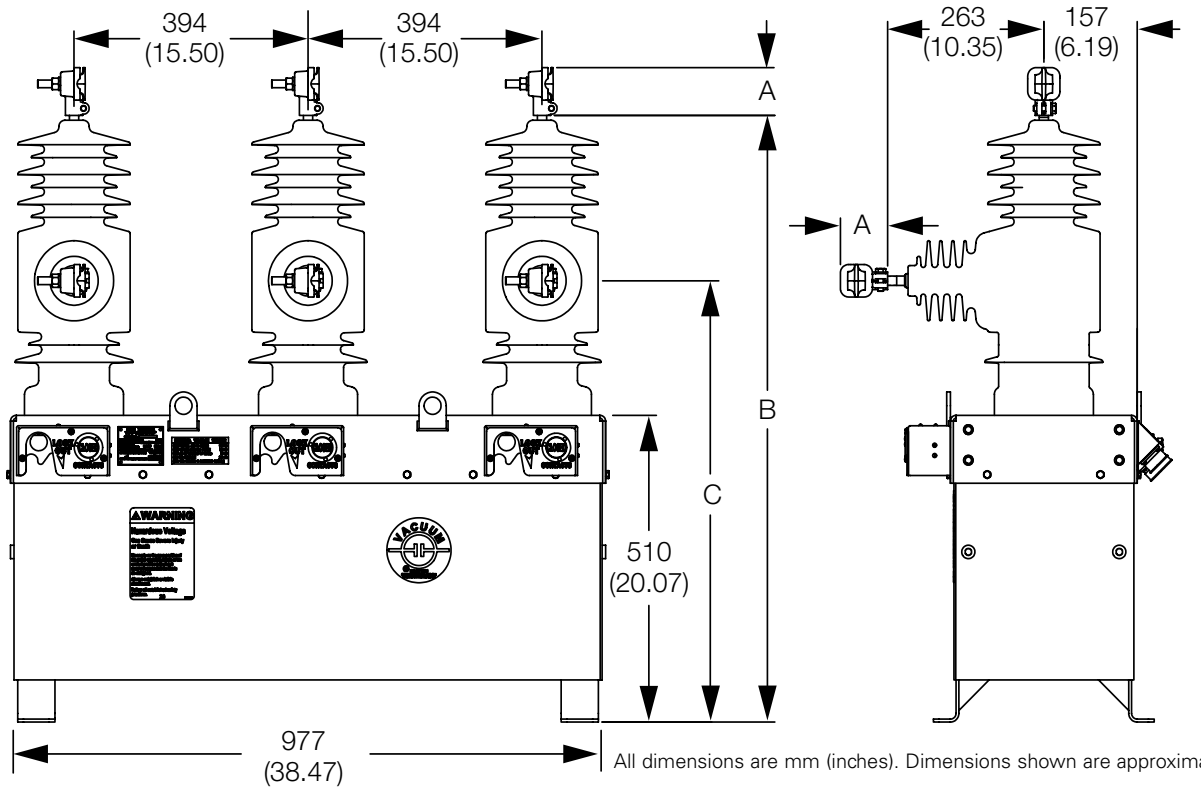


Table 6. Terminal options	
Description	**A**
Eyebolt, 1/0 - 500 mcm Cable Range (630 A maximum)	80 (3.25)
Eyebolt, 4/0 - 1000 mcm Cable Range (800 A maximum)	108 (4.25)
Flat Pad, 2-hole (630 A maximum)	114 (4.5)
Flat Pad, 4-hole (800 A maximum)	121 (4.75)
Stud Type, 1.125 - 12 threads (800 A maximum)	82 (3.25)

Table 7. Terminal options (continued)		
Description	**B**	**C**
NOVA STS 15 110 kV BIL	1008 (39.75)	733 (29)
NOVA STS 15 125 kV BIL	1064 (42)	789 (31)
NOVA STS 27 125 kV BIL	1064 (42)	789 (31)
NOVA STS 27 150 kV BIL	1163 (45.75)	888 (35)
NOVA STS 38 170 kV BIL	1163 (45.75)	888 (35)

Table 8. Creepage distances					
Description	**15 kV 110 kV BIL**	**15 kV 125 kV BIL**	**27 kV 125 kV BIL**	**27 kV 150 kV BIL**	**38 kV 170 kV BIL**
Terminal to terminal	1040 (40.9)	1040 (40.9)	1040 (40.9)	1040 (40.9)	1040 (40.9)
Lower terminal to ground/earth	673 (26.5)	772 (30.5)	772 (30.5)	950 (37.5)	950 (37.5)

Figure 1. NOVA STS recloser dimensions, NOVA STS 15 shown.

Installation procedure

⚠ WARNING

Hazardous voltage. Always use a hotstick when working with this equipment. Failure to do so could result in contact with high voltage, which will cause death or severe personal injury. G108.1

⚠ WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury, and equipment damage. G102.1

When installing the recloser, refer to the applicable recloser mounting frame instructions. Installation instructions are included with the mounting frame.

1. **Check the data plate ratings**. Make sure the ratings, settings, and interface options on each recloser data plate (see Figure 2) are correct for the planned installation.

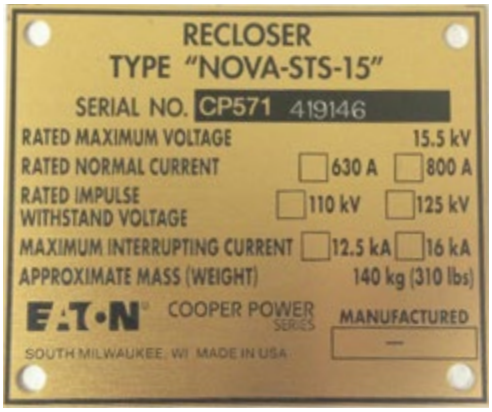


Figure 2. NOVA STS recloser data plate.

2. **Perform high-potential withstand tests**. Prior to installing the NOVA STS recloser, perform high-potential withstand tests. Refer to the **Service information** section for high-potential withstand test procedures. This test will help identify any shipping damage affecting the dielectric condition of the recloser or the vacuum integrity of the interrupter.

⚠ CAUTION

Personal injury. Sheds on epoxy encapsulation have sharp edges. Wear protective gloves when handling the unit. Failure to do so can result in cuts and abrasions. T258.1

3. **Install the recloser**. Install the recloser in the appropriate Eaton's Cooper Power series pole- or substation mounting frame. See Figure 3 for moving and lifting instructions.

⚠ WARNING

Falling equipment. Use the lifting lugs provided and follow all locally approved safety practices when lifting and mounting the equipment. Lift the unit smoothly and do not allow the unit to shift. Improper lifting can result in severe personal injury, death, and/or equipment damage. G106.3

Moving the recloser

The NOVA STS reclosers are shipped palletized (bolted onto a pallet). When moving with a fork truck/lift, the recloser must remain bolted to the pallet to avoid damage.

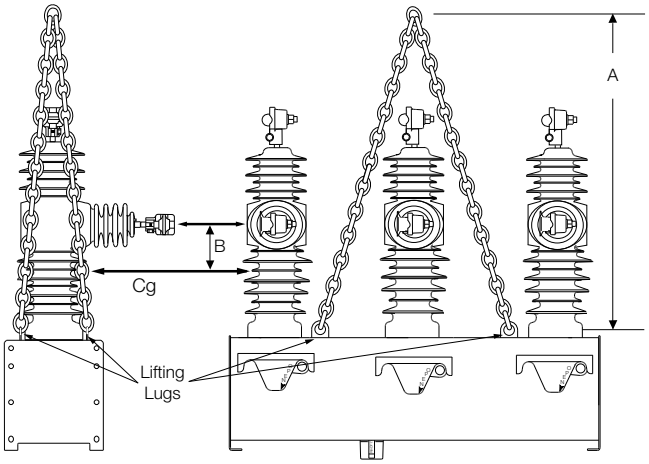
Eaton recommends transporting Cooper Power series NOVA reclosers in the closed position to maximize the operational performance of the unit.

Lifting the recloser

Follow all approved safety practices when making hitches and lifting the equipment. Lift the unit smoothly and do not allow the unit to shift.

⚠ CAUTION

Tip-over hazard. High center of gravity. Use a 4-point hitch to prevent switchgear from overturning during lifting operations. Improper lifting can result in personal injury or equipment damage. T297.0



A: Sling height for 15 kV and 27 kV with 125 BIL units: 914 mm (36 in
Sling height for 27 kV with 150 BIL and 38 kV units: 1067 mm (42 in)
B: Center of gravity (Cg) is approximately 254 mm (10 in) below plane of lower terminals.

Figure 3. Moving and lifting the NOVA STS recloser.

⚠ WARNING

Hazardous voltage. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage. T223.2

4. **Ground the reclosers and mounting hanger**. Make the ground connection to the ground connector in accordance with approved utility standards. The ground connector is located on the back of the mechanism housing. See Figure 4 for ground connector location. The ground clamp accepts #10 to #2 stranded cables. See Figures 8 and 9 for recommended grounding for the NOVA STS recloser.

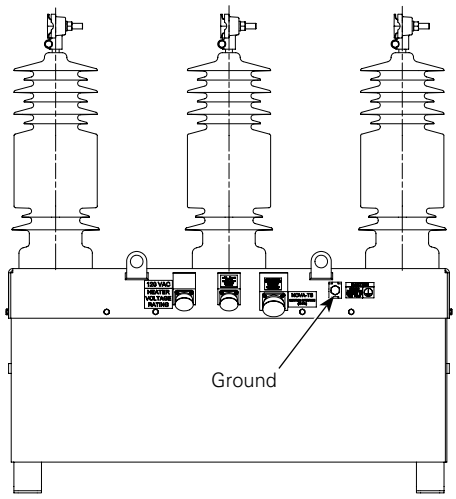


Figure 4. NOVA STS recloser ground and receptacles.

5. **Install the control**. Refer to *Service Information S280-70-7 Form 6 Triple-Single, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions*. Make sure the control cable is connected between the control and the recloser, the control is properly programmed for the planned installation, and the control is grounded.

   To ensure proper installation of this cable, securely fasten the aluminum cable coupler ring (Figure 5).

Figure 5. Cable with aluminum cable coupler ring.

⚠ CAUTION

Equipment damage. Check the heater input power label located near the receptacle on the recloser to insure the input power matches the heater rating. Failure to comply can result in recloser misoperation and equipment damage. T354.0

6. **Connect heater power cable**. The recloser tank includes either a 120 Vac or 240 Vac heater for humidity control. Connect the two-wire input cable to the recloser input receptacle.

7. **Make bypass and disconnect provisions in accordance with approved utility standards**: the recloser contacts are open, the bypass switches are closed, and the disconnected switches are open.

Note: Disconnect switches and bypass switches are not required, but are highly recommended as they facilitate switching and isolation. Disconnect switches for AC sensing and power connections are necessary to isolate the Form 6-TS control for testing and servicing.

⚠ CAUTION

Equipment damage. Do not adjust or rotate bushing terminals. The bushing terminals are factory-calibrated to meet the continuous current requirement of the switchgear. Adjusting or rotating the bushing terminals can damage the encapsulated interrupter, resulting in equipment damage or personal injury. T270.0

CAUTION

Equipment damage may occur if torque values are exceeded. T370.0

8. **Make the high-voltage line connections**.

   A. Connect high-voltage lines to recloser bushings terminals. Refer to Figure 6 for terminal identification of the NOVA STS recloser. Terminal connection to copper conductors only are recommended.

   To rotate a flat-pad or eyebolt bushing terminal prior to connecting power line leads, loosen the pinch bolt on the terminals. After rotating the terminal, retighten the pinch bolt as follows: torque 3/8-16 pinch bolts to 20—23 Nm (15—17 ft•lbs); torque 1/2-13 pinch bolts to 39—42 Nm (29—31 ft•lbs).

   Recommended torque for bushing terminal to line connection of 45-50 ft•lbs.

IMPORTANT

The default connections use the horizontal bushing as the source side and vertical bushing as the load side. Also, the horizontal bushing may be used as the load side and vertical bushing as the source side. Note that reversing the source and load bushings has no effect on overcurrent protection but may require setting or wiring changes to the control for correct metering.

If equipped with internal voltage sensors, the horizontal bushings (1, 3, 5) must be connected to the source. The internal voltage sensors cannot monitor source-side voltage when the NOVA STS recloser is in the OPEN position if the horizontal bushings are connected to the load.

⚠ WARNING

Hazardous voltage. If terminal connections are reversed, the internal voltage sensing option may indicate zero voltage with the contacts open. Do not rely on internal voltage sensing to ensure that the voltage is zero and the line has been de-energized. Always follow proper safety practices and use a separate detection method to verify a de-energized condition. Failure to do so can result in contact with high voltage, which will cause death or severe personal injury. T365.0

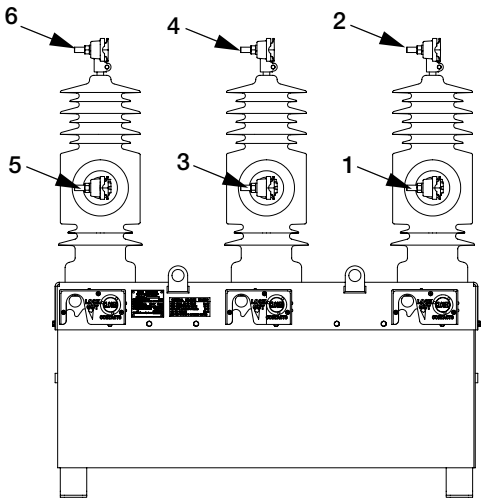


Figure 6. Terminal Identification of the NOVA STS recloser.

B. Provide surge arrester protection. Surge arrester protection should be provided on both sides; refer to Figure 7.

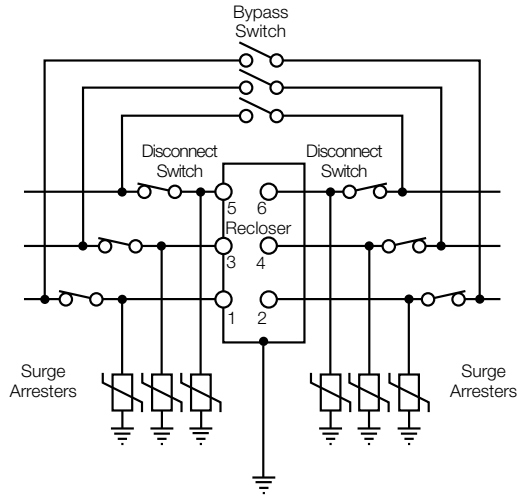


Figure 7. Connection diagram shows complete surge protection and illustrates bypass and disconnect switches.

9. Block ground sensing via the control panel.
10. Close source and load disconnect switches.
11. Close all three phases via control signal.
12. Open bypass switches.
13. Enable ground sensing, if applicable.

Remove recloser from service

⚠ WARNING

Hazardous voltage. Always use a hotstick when working with this equipment. Failure to do so could result in contact with high voltage, which will cause death or severe personal injury. G108.1

⚠ WARNING

Hazardous voltage. Do not rely on the open position of the yellow operating handle or the contact position indicator; it does not ensure that the line has been de-energized. Always establish a visible disconnect. Failure to follow proper safety practices can result in contact with high voltage, which will cause death or severe personal injury. G114.1

1. Block ground tripping via the control panel. Refer to *Service Information S280-70-7 Form 6 Triple-Single, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions*.

CAUTION

Equipment misoperation. Disconnect all control power sources prior to disconnecting or reconnecting the control cable from the control. Failure to comply can result in recloser misoperation at the time of disconnection or reconnection of the control cable to the control. T311.1

2. Close all three bypass switches.

Note: If only one bypass switch is closed and the recloser is opened via the yellow operating handle, it is possible all three phases will trip based upon mode selection.

3. Open the source and load disconnect switches.
4. Pull down all three yellow operating handles with a hotstick. The yellow operating handles are located under the recloser sleet hood.
   - If the recloser is set in single-phase trip/single-phase lockout mode, only one phase will open.
   - If the recloser is set in single-phase trip/three-phase lockout mode or three-phase trip/three-phase lockout mode, all three phases will open.
5. The control will sense that all three recloser phases are open.

6. Disconnect the control battery.
7. For the Form 6 Triple-Single control, remove the control AC sensing and power connections from the control using a separate disconnect switch.

IMPORTANT

Disconnect switches for AC sensing and power connections are necessary to isolate the Form 6 control for testing and servicing.

⚠ CAUTION

Hazardous voltage. Open CT secondaries can generate high voltages. Contact with CT pins of the disconnected cable can cause electric shock and may result in personal injury. Open recloser contacts and open disconnect switches before disconnecting control cable.

T204.3

⚠ CAUTION

Hazardous voltage. Cable conductors attached to controls will remain at 53 Vdc and 120/240 Vac potential while connected to the control. Contact with any pins at the end of the cable directly or indirectly connected to a control can result in personal injury or equipment damage. Disconnect battery and external power sources in the control then remove control cable at control end before disconnecting from recloser end. **T312.3**

8. Disconnect the control cable from the recloser.

Note: Do not disconnect the recloser control cable from the recloser unless all of the above steps have been completed. The Form 6 Triple-Single control in 1-phase trip/3-phase lockout mode or 3-phase trip/3-phase lockout mode will lock out all three reclosers if the control cable is disconnected.

9. Disconnect heater power cable from the recloser tank.
10. Follow standard utility procedures regarding removal of recloser from service.
    - Eaton recommends transporting Cooper Power series NOVA reclosers in the closed position to maximize the operational performance of the unit.

Grounding the NOVA STS recloser

IMPORTANT

In pole-mounted applications, a ground connection must be made between the recloser, transformer, recloser control, and SCADA equipment for proper protection of the equipment. The pole ground must be sized per local utility practices to minimize the impedance between the recloser ground and the control ground.

IMPORTANT

All external inputs to the Form 6-TS control must be routed within 8 inches of their corresponding ground. During a surge, a potential of approximately 1.5 kV per foot can develop in the conductors. Differences between conductor and ground path lengths can add additional stress to the control components in the event of a power surge.

IMPORTANT

Any external voltage sensor installed with the NOVA STS recloser must have its ground referenced to the recloser ground.

Grounding with a local supply voltage transformer: 4-wire multi-grounded, 3-wire ungrounded, or impedance-grounded

Installation with a local supply voltage transformer must include the following (refer to Figure 8):

- Protection of the recloser bushings and the supplying transformer with lightning arresters.
- Grounding of the recloser head and tank.
- Grounding of the transformer tank.
- Grounding of the control cabinet.
- Grounding of the SCADA equipment.

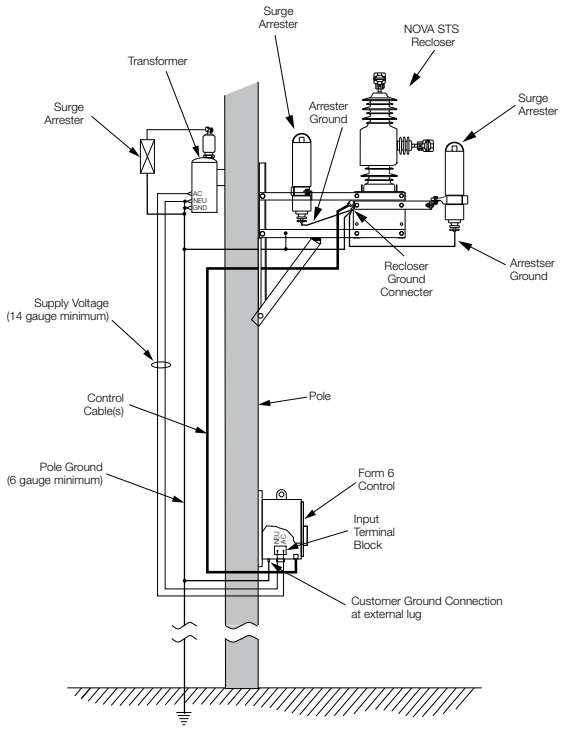


Figure 8. Recommended grounding method for NOVA STS recloser with Form 6-TS microprocessor-based recloser control.

Grounding with a remote supply voltage transformer: 4-wire multi-grounded, 3-wire ungrounded, or impedance-grounded

Installation with a remote supply voltage transformer must include the following (refer to Figure 9):

- Protection of the recloser bushings and the supplying transformer with lightning arresters.
- Grounding of the recloser head and tank.
- Grounding of the transformer tank.
- Grounding of the control cabinet.
- Grounding of the SCADA equipment.

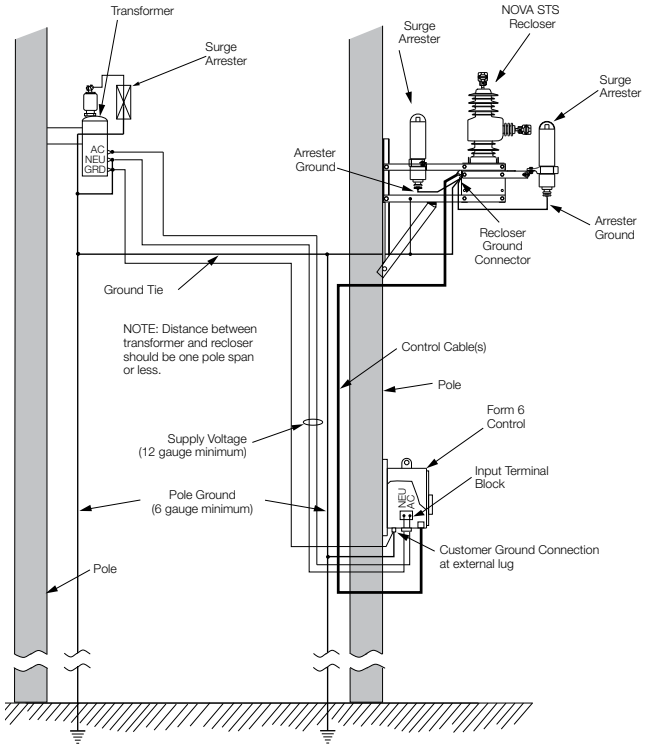


Figure 9. Recommended grounding method for NOVA STS recloser with Form 6-TS microprocessor-based recloser control.

Recloser operation

⚠ WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury, and equipment damage. G102.1

⚠ WARNING

Hazardous voltage. Do not rely on the open position of the yellow operating handle or the contact position indicator; it does not ensure that the line has been de-energized. Always establish a visible disconnect. Failure to follow proper safety practices can result in contact with high voltage, which will cause death or severe personal injury. G114.1

A current transformer senses line current from each phase of the NOVA STS recloser and inputs this information to the Form 6 Triple-Single microprocessor-based recloser control. The recloser responds to trip and close commands from the control per the settings programmed in the control. Refer to *Service Information S280-70-7 Form 6 Triple-Single, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* for control operation information.

Vacuum interrupter

Arc interruption takes place within the sealed vacuum interrupter. Eaton's Cooper Power series vacuum interrupters employ axial-magnetic field contacts. Slots are machined into the contact support structure producing a magnetic field along the axis of the interrupter. This axial-magnetic field keeps the arc in an easier-to-interrupt diffuse mode, resulting in less power in the arc that needs to be dissipated, resulting in extended operating duty.

Mechanism tripping and closing

The NOVA STS recloser is comprised of three single-phase NOVA reclosers. Each recloser utilizes a magnetic actuator for fast, efficient latching. A rare-earth neodymium magnet provides latching forces in excess of 240 pounds, eliminating the need for mechanical latches.

While in the closed position, the magnetic field established by the magnet is coupled with the iron assembly to provide a latching force for the movable plunger. The magnetic force is concentrated at the plunger-assembly interface and provides the latching force required to keep the mechanism closed. The assembly also houses the trip and close coils that provide the energy to operate the mechanism.

To open the main contacts, the trip coil is pulsed with electrical current, which cancels the magnetic field. A compression spring in the center of the coil moves the plunger assembly to the open position. As the plunger moves, the magnetic field strength decreases as the air gap increases, due to the difference in the relative permeability of free space and the ferrous plunger. Once in the open position, the compression spring keeps the unit open.

A trip and close capacitor stores the necessary energy for operating the recloser. As a result, trip energy is available following any close operation. This capacitor is charged by the control nominal 24 V battery and/or power supply.

Electronic control

Refer to *Service Information S280-70-7 Form 6 Triple-Single, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* for control operation information.

Manual operation of energized recloser

⚠ WARNING

Hazardous voltage. Do not rely on the open position of the yellow operating handle or the contact position indicator; it does not ensure that the line has been de-energized. Always establish a visible disconnect. Failure to follow proper safety practices can result in contact with high voltage, which will cause death or severe personal injury. G114.1

The yellow manual operating handles on each single-phase unit in the NOVA STS recloser are used to open and lock out each unit and disable the electrical and supervisory closing.

The recloser mode of operation determines which phases open and close. The Form 6 Triple-Single control initiates the close signal. Refer to *Service Information S280-70-7 Form 6 Triple-Single, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* for control operation information.

⚠ WARNING

Hazardous voltage. Always use a hotstick when working with this equipment. Failure to do so could result in contact with high voltage, which will cause death or severe personal injury. G108.1

The manual operating handle is designed to be operated with a hotstick. See Figure 10. Pulling down the handle trips and locks open the main contacts of the recloser. Contact position is indicated by the OPEN flag of the contact position indicator. The yellow operating handle will remain down in the OPEN position and not return upward under the sleet hood.

Note: When the recloser electronically operates to lockout, the yellow operating handle will not drop down from under the sleet hood. The yellow operating handle remains in the OPEN position only after manual operations are performed.

The yellow operating handle must be returned up to the CLOSED position for the recloser to respond to a close signal from the Form 6 Triple-Single control. All close operations are initiated by the control.

IMPORTANT

Pushing the yellow operating handle to the CLOSED position will not close the recloser. All close operations are initiated by the Form 6 Triple-Single control.

3-Phase trip/3-phase lockout or 1-phase trip/3-phase lockout

If the control is in Three-Phase Trip/Three-Phase Lockout or Single-Phase Trip/Three-Phase Lockout mode, all three phases will lock out when the yellow operating handle on one phase is pulled down to the OPEN position.

1-Phase trip/1-phase lockout

When the control is in Single-Phase Trip/Single-Phase Lockout mode, only the phase with the yellow handle pulled down to the OPEN position will lock out. The other two phases will not be affected and their yellow operating handles will remain in the CLOSE position.

Lockout indication

Lockout is indicated by the Form 6 Triple-Single control.

Note: When the recloser is locked out, the yellow manual operating handle will not drop down from under the sleet hood.

Automatic operation

The NOVA STS recloser, in the CLOSED position, operates automatically per the control-programmed settings.

Figure 10. NOVA STS recloser operating handles and indicators

Contact position indicator

Located on the outboard side of the sleet hood, this indicator displays the word OPEN (Green) when the recloser contacts are open and CLOSED (Red) when the recloser contacts are closed. See Figure 10.

Operations counter

A four-digit mechanical counter, located under the sleet hood shown in Figure 10, cumulatively records each time the recloser operates.

Actuator circuit board

The actuator circuit board, located within the mechanism, drives the mechanism based upon signals sent from the control. The actuator board manages the high power path by providing precharge and discharge capabilities and provides the proper current pulses and timing to the mechanism. It also prevents closing when there is insufficient energy stored in the trip and close capacitor.

Trip and close capacitor

⚠ WARNING

Personal injury. The trip and close capacitor retains an electrical charge. Always discharge the trip and close capacitor prior to performing any service on the mechanism. Contact with a charged capacitor can result in skin burn or electrical shock. T266.0

A trip and close capacitor, located within the mechanism, stores the necessary energy for operating the recloser.

The Discharge Trip and Close Capacitor procedure is located in the **Service information** section.

Internal voltage sensing option

⚠ WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury, and equipment damage. G102.1

⚠ WARNING

Hazardous voltage. Always use a hotstick when working with this equipment. Failure to do so could result in contact with high voltage, which will cause death or severe personal injury. G108.1

⚠ WARNING

Hazardous voltage. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage. T223.2

IMPORTANT

Disconnect switches for AC control power are necessary to isolate the control for testing and servicing.

⚠ WARNING

Hazardous voltage. If terminal connections are reversed, the internal voltage sensing option may indicate zero voltage with the contacts open. Do not rely on internal voltage sensing to ensure that the voltage is zero and the line has been de-energized. Always follow proper safety practices and use a separate detection method to verify a de-energized condition. Failure to do so can result in contact with high voltage, which will cause death or severe personal injury. T365.0

The NOVA STS recloser is available with internal voltage sensing when specified at time of order with the Form 6 Triple-Single control. Refer to the **Installation procedure** section of this manual for information on the NOVA STS recloser installation procedure. Refer to *Service Information S280-70-7 Form 6 Triple-Single, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* for further information on installing the Form 6 Triple-Single pole-mount control.

Verify the correct load-side and source-side terminal connections. This is required for correct operation of the internal voltage sensors.

Verify correct ground of the NOVA STS recloser and control prior to making any high-voltage connections and before high-potential testing. A proper ground connection consists of a good electrical ground connection to the surge ground connector located on the mechanism housings. Provide a good electrical ground connection to the control cabinet ground.

Note: Painted surfaces of the mechanism housing may prevent a ground connection to the recloser housing. Always provide a good electrical connection to the mechanism surge ground connector.

Poor grounding of the mechanism housing may result in the presence of high voltage on the mechanism housing associated with the high-voltage resistor connections used with internal voltage sensing.

⚠ CAUTION

Hazardous voltage. Do not touch the receptacle connections of the control/voltage-sensing cable. If the recloser is energized and the control/voltage-sensing cable is disconnected from the recloser or the control, a voltage clamped at 250 Vac will be present at the receptacle. Contact with this voltage can result in personal injury. T346.1

The recloser utilizes a 26-pin control cable to carry the internal voltage sensing signal from the recloser to the control. There are no additional external connections required.

CAUTION

Equipment misoperation. Verify all connector pins and both mating interface surfaces are clean and dry before connecting cables. Voltage sensing errors can result from contamination. Failure to comply can result in control and recloser misoperation. G142.0

The electrical connectors of the recloser, control, and cable must be clean and dry. Contaminated surfaces may be cleaned with denatured alcohol and wet connector surfaces may be dried with a heat gun. Dry surfaces are particularly important for the internal voltage sensor connections. The accuracy of the sensors can be influenced by moisture contamination.

Connect control cables and power cables to the control; refer to Figure 11. Verify that the proper cable/receptacle connections are made. Improper cable connections can result in damage to the recloser and/or control.

Complete the control programming before making the high-voltage line connections. See the **Recloser operation** section of this manual.

The Form 6 Triple-Single control must be programmed with a PT ratio and a phase angle adjustment; refer to Tables 9 and 10. These are entered in the System Configuration screen; see Figure 12.

When programming the Form 6 Triple-Single control, the PT connection must be set for a wye connection. Also, the Phantom Phase feature must be disabled.
Refer to *Service Information S280-70-7 Form 6 Triple-Single, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* for more information on installing the Form 6 Triple-Single control.

Table 9. PT Ratio

Description	Form 6-TS Control PT Ratio
NOVA STS-15	1100:1
NOVA STS-27	2200:1
NOVA STS-38	2200:1

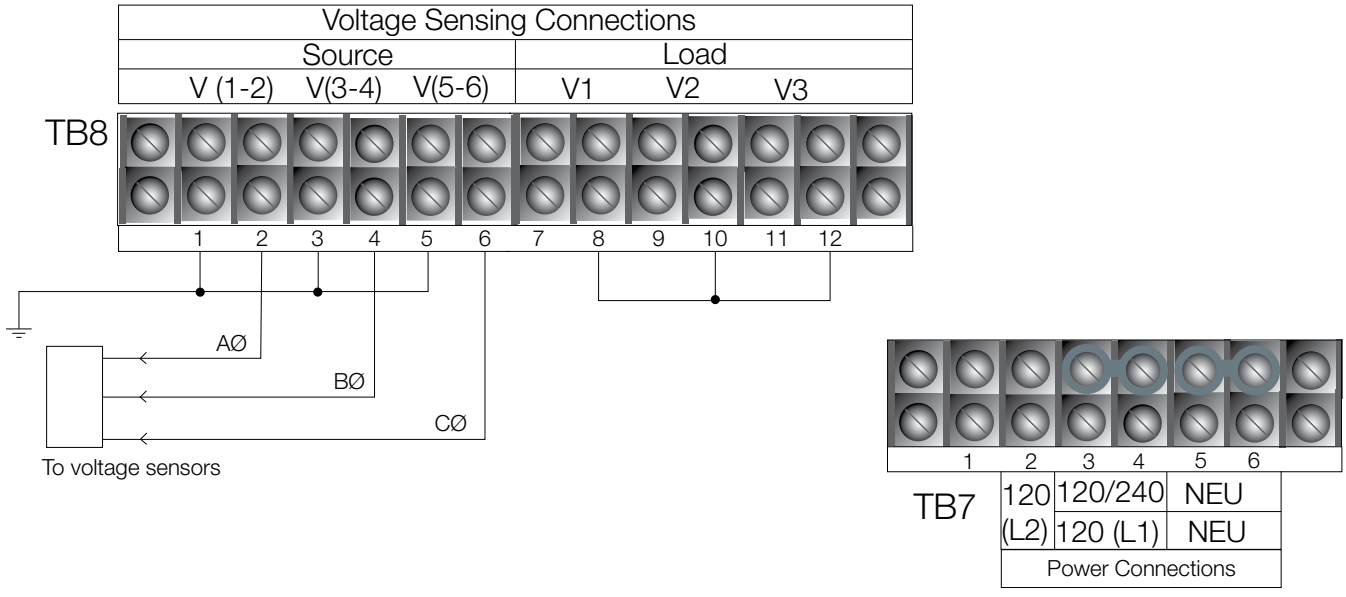
Table 10. Phase Angle Adjustment

Description	Form 6-TS Control Phase Shift, 3.05 m (10 ft.) 26-pin control cable
NOVA STS-15	-179.1° *
NOVA STS-27	-177.7° **
NOVA STS-38	-175.1° ***

* For each additional 3.05 m (10 ft.) of control cable, a correction of +0.3° must be added.

** For each additional 3.05 m (10 ft.) of control cable, a correction of +0.4° must be added.

*** For each additional 3.05 m (10 ft.) of control cable, a correction of +0.2° must be added.



Note: Terminal block positions TB7-3 and TB7-4 are factory-jumpered together.

Terminal block positions TB7-5 and TB7-6 are factory-jumpered together.

Figure 11. Default factory wiring for internal voltage sensor option.

⚠ CAUTION

Equipment misoperation. Do not connect this control to an energized recloser until all control settings have been properly programmed and verified. Refer to the programming information for this control. Failure to comply can result in control and recloser misoperation, equipment damage, and personal injury. G110.3

Make appropriate electrical connections to the terminals of each phase of the recloser. Energize the recloser and confirm the voltage outputs in the control.

⚠ CAUTION

Hazardous voltage. Do not touch the receptacle connections of the control/voltage-sensing cable. If the recloser is energized and the control/voltage-sensing cable is disconnected from the recloser or the control, a voltage clamped at 250 Vac will be present at the receptacle. Contact with this voltage can result in personal injury. T346.1

When the reclosers are energized, the recloser control input impedance to the voltage sensors lowers the voltage to 6 V during normal operation. If the recloser is energized and the control/voltage-sensing cable is disconnected at any point (the control or the reclosers), the voltage-sensing output signal of 250 Vac will be present at the receptacle: Do not touch the male receptacle connections of the control/voltage-sensing cable.

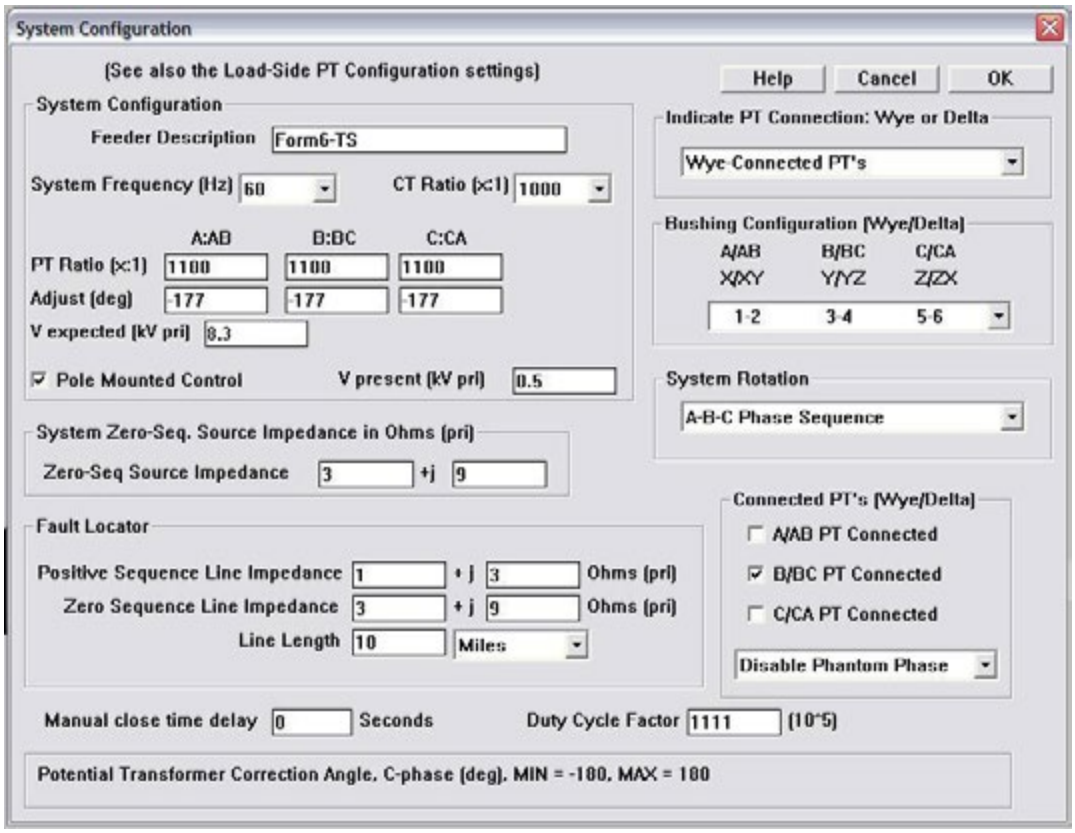


Figure 12. Form 6 Triple-Single System Configuration screen representation configured for a 15 kV system.

Accessories

Auxiliary switch

A single-stage auxiliary switch can be provided as an accessory on each phase of the recloser. Each switch consists of two independent contacts that permit any desired combination of "a" and "b" contacts, allowing for remote monitoring of the recloser.

The switch contacts are insulated for 600 V and have a continuous current rating of 10 A. Their interrupting ratings are shown in Table 11.

Table 11. Auxiliary Switch Interrupting Ratings

Volts	Inductive AC (A)	Non-Inductive AC (A)	Inductive DC (A)	Non-Inductive DC (A)
24	–	–	15.0	20.0
48	–	–	7.5	10.0
120	60	80	–	–
125	–	–	1.5	2.0
240	30	60	–	–
250	–	–	0.45	0.5

Table 12. Auxiliary Switch Pin Contacts and Cable Wire Colors

Recloser Phase*	Contact Type**	Wire Color***	Receptacle Pin
A-phase	a	black white	A B
A-phase	b	red green	C C
B-phase	a	orange blue	E F
B-phase	b	white/black red/black	G H
C-phase	a	green/black orange/black	J K
C-phase	b	blue/black black/white	L M
unused	unused	unused	N, P

* See Figure 6. A-phase is designated as terminals 1 and 2.
B-phase is designated as terminals 3 and 4.
C-phase is designated as terminals 5 and 6.
** The "a" contacts are normally open; "b" contacts are normally closed.
*** The wire color of the factory-supplied cable accessory.

Terminal options

The NOVA STS recloser can be specified with eyebolt terminals (630 A and 800 A), two-hole (630 A) or four-hole (800 A) flat-pad terminals, or stud-type terminals (800 A).

The eyebolt, flat-pad, and stud terminals are made of copper alloys. Eaton recommends terminal connection to copper wires to optimize the electrical connection. Aluminum cables may produce aluminum oxide sufficient to compromise the electrical connections.

Anti-oxide coatings for temporary protection of wire-brushed, aluminum cable connections to flat-pad or stud terminals must be maintained at intervals determined by the customer based on load current, climate, and other installation conditions.

Eyebolt terminals are recommended for copper conductors only.

Site-ready pole-mounting hanger

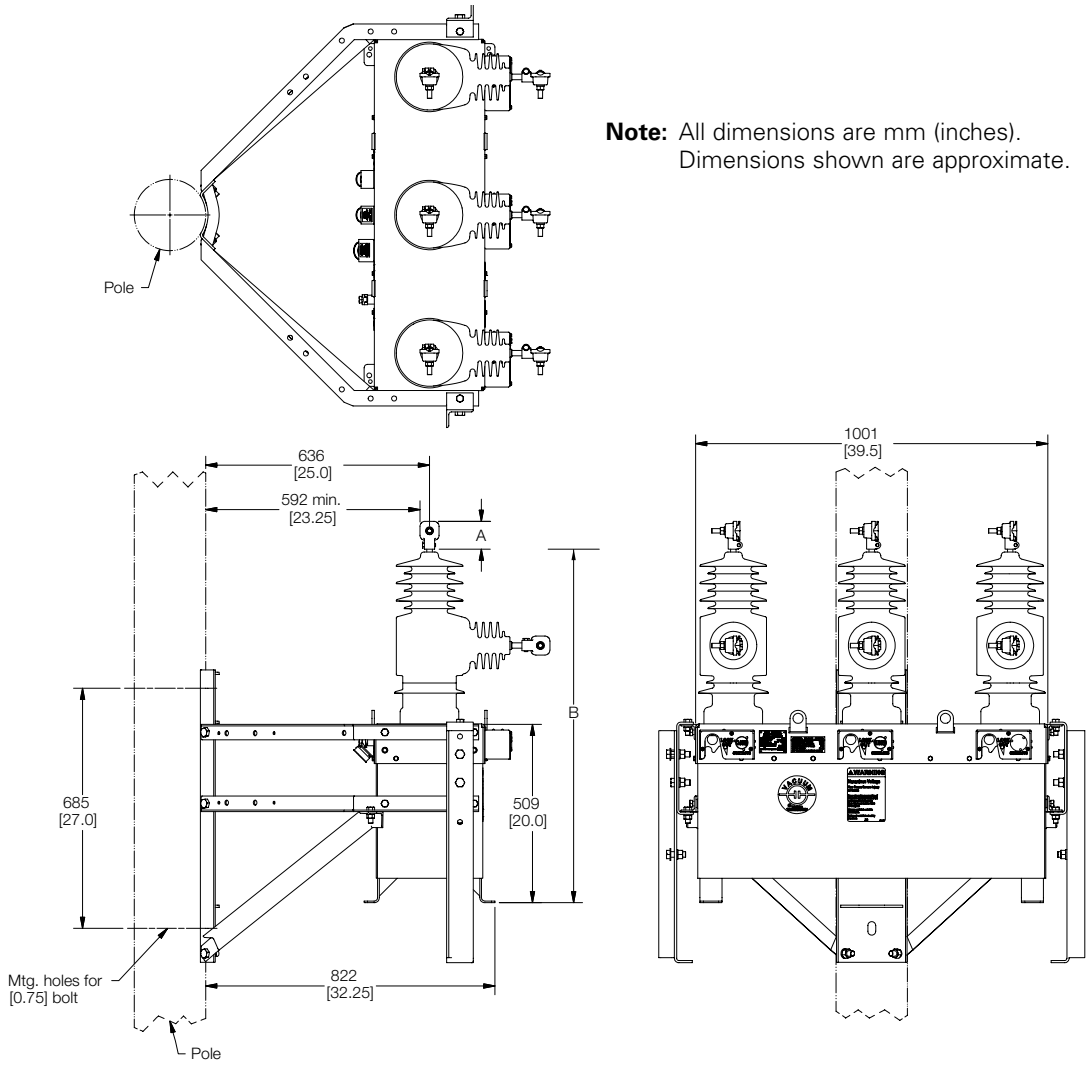
A pre-assembled site-ready pole-mounting hanger, which bolts directly to the recloser frame, is available for pole-mounting installation. Refer to Figure 13.

Table 13. Terminal options

Description	A
Eyebolt, 1/0 - 500 mcm Cable Range (630 A maximum)	80 (3.25)
Eyebolt, 4/0 - 1000 mcm Cable Range (800 A maximum)	108 (4.25)
Flat Pad, 2-hole (630 A maximum)	114 (4.5)
Flat Pad, 4-hole (800 A maximum)	121 (4.75)
Stud Type, 1.125 - 12 threads (800 A maximum)	82 (3.25)

Table 14. Terminal options (continued)

Description	B
NOVA STS 15 110 kV BIL	1008 (39.75)
NOVA STS 15 125 kV BIL	1064 (42)
NOVA STS 27 125 kV BIL	1064 (42)
NOVA STS 27 150 kV BIL	1163 (45.75)
NOVA STS 38 170 kV BIL	1163 (45.75)

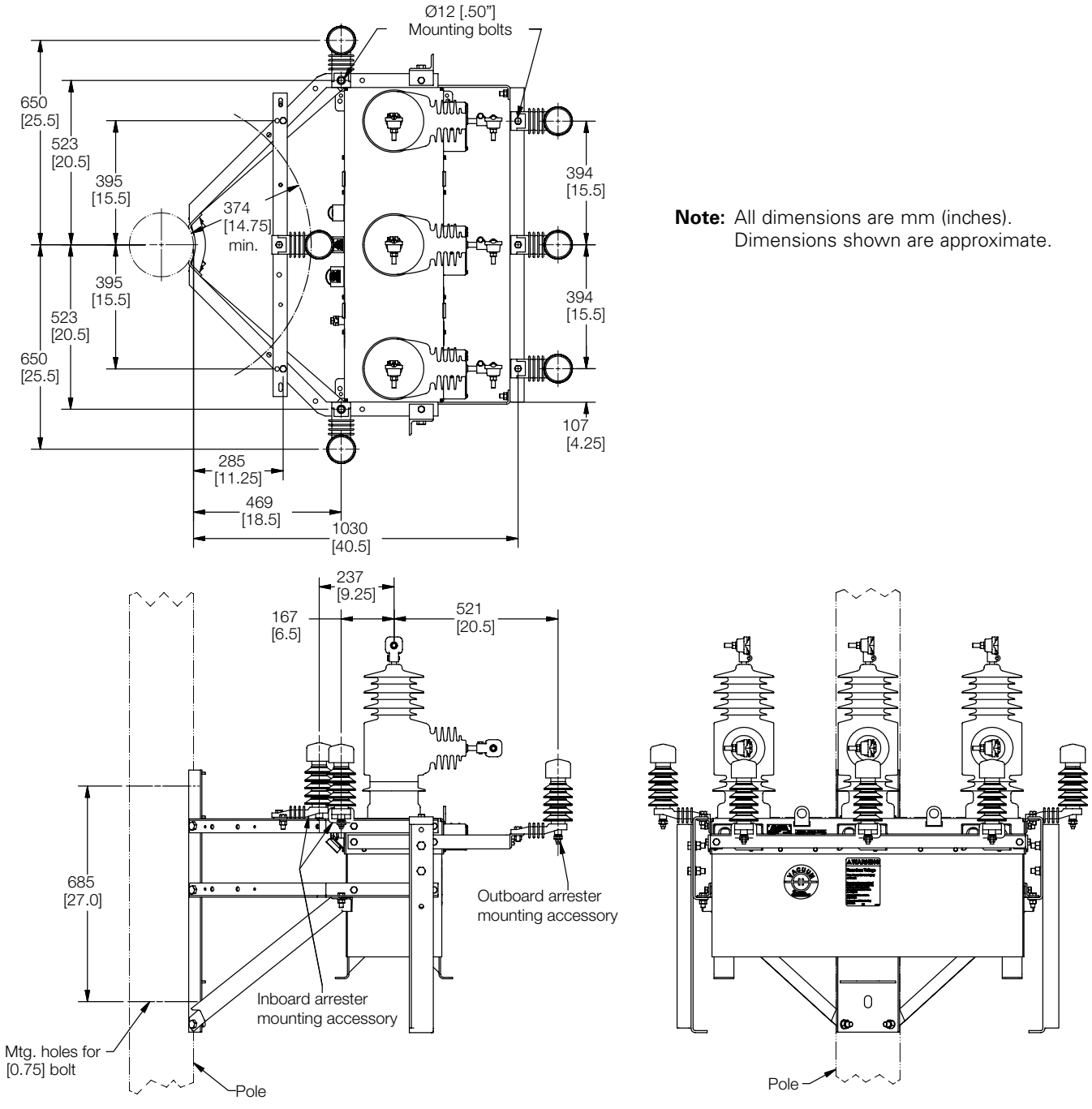


Note: All dimensions are mm (inches). Dimensions shown are approximate.

Figure 13. Dimensions of NOVA STS recloser with site-ready pole mounting hanger accessory.

Arrester-mounting brackets

The arrester-mounting bracket accessory can be bolted to the recloser frame and pole-mounting hanger for the addition of inboard and outboard arresters. The arresters are not included with the brackets. Refer to Figure 14.



Note: All dimensions are mm (inches). Dimensions shown are approximate.

Figure 14. Dimensions of NOVA STS recloser with site-ready pole-mounting hanger and arrester-mounting bracket accessories.

Service information

Service requirements

The NOVA STS recloser requires minimum routine inspection to check for physical damage and verify proper operation.

It should not be necessary to access the mechanism of the NOVA STS recloser. If entry is required, the trip and close capacitor must be discharged prior to any contact with the mechanism. The capacitor retains an electrical charge, even with the control cable disconnected.

Discharge trip and close capacitor

⚠ WARNING

Personal injury. The trip and close capacitor retains an electrical charge. Always discharge the trip and close capacitor prior to performing any service on the mechanism. Contact with a charged capacitor can result in skin burn or electrical shock. T389.0

To discharge the trip and close capacitor:

1. Remove the recloser from service. Refer to the **Remove recloser from service** section of this manual. Follow standard utility procedures regarding removal of the recloser from service. Refer to the section in this manual on moving and lifting the NOVA STS recloser.

⚠ WARNING

Falling equipment. Use the lifting lugs provided and follow all locally approved safety practices when lifting and mounting the equipment. Lift the unit smoothly and do not allow the unit to shift. Improper lifting can result in severe personal injury, death, and/or equipment damage. G106.3

2. Loosen bolts that secure the tank and remove the tank bottom from the tank top.

CAUTION

Equipment damage. Always unplug the control cable from the control prior to discharging the capacitor. Failure to do so can result in resistor damage. T267.0

3. Locate the white discharge button on each actuator circuit board. See Figure 15.

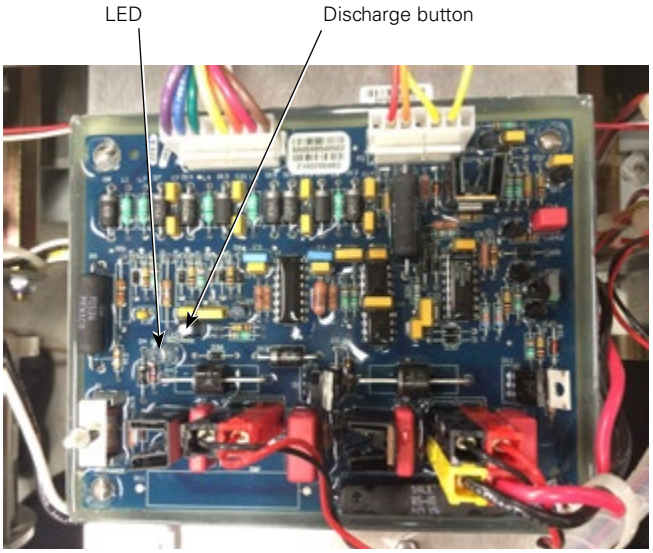


Figure 15. Location of white discharge button and LED discharge indicator on actuator circuit board.

4. Push and hold in the discharge button. The discharge LED will light up and gradually dim as capacitor energy is discharged. This will take approximately 45 to 60 seconds.
5. When the light completely dims, release the button.
6. The capacitor is now discharged.

Note: This procedure must be completed on all three actuator boards prior to conducting maintenance.

Note: After approximately twenty minutes, the discharged capacitor may have recharged up to 7 volts. If this occurs, the Discharge LED will light up if the Discharge button is pushed.

7. Reassemble the tank. Tighten the twelve bolts that secure the tank to approximately 7 Nm (5 ft•lbs).

Frequency of inspection

Because these reclosers are applied under widely varying operating and climatic conditions, service intervals are best determined by the user based on actual operating experience. However, solid-insulated, vacuum-interrupting reclosers should be inspected every ten years.

High-potential withstand testing

Eaton's Cooper Power series NOVA-STS reclosers are carefully tested and adjusted at the factory to operate according to the published data. Each recloser leaves the factory ready for installation, but to ensure there was no damage during transportation, Eaton recommends high potential withstand tests before installation.

To verify the dielectric integrity of the recloser, the following tests and equipment are recommended:

High-voltage test set – Must be capable of supplying suitable voltages for determining the dielectric withstand capability of the recloser. Sensitive circuit breakers should be included to prevent damage in the event of a flashover.

Note: Test results for NOVA reclosers equipped with the internal voltage sensing option will be influenced by the source-to-ground connected sensing resistor, especially if DC high-potential testing is performed.

⚠ WARNING

Hazardous voltage. The switchgear (apparatus and control) and high-voltage transformer must be in a test cage or similar protected area to prevent accidental contact with the high-voltage parts. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage. T221.5

⚠ CAUTION

Radiation. At voltages up to the specified test voltages, the radiation emitted by the vacuum interrupter is negligible. However, above these voltages, radiation injurious to personnel can be emitted. See *Service Information S280-90-1, Vacuum Interrupter Withstand Test Voltage Ratings Information* **for further information.** G109.2

Use the procedures on page 18 to perform high-potential withstand tests at 75% of the rated low-frequency withstand voltage for 60 seconds. See Table 15 for test voltages and Figure 16 for test connection diagrams.

Table 15. NOVA STS Recloser Withstand Test Voltage Ratings Information

Description	75% of Rated Low-Frequency Withstand Voltage (1 minute dry) (kV rms)	
	AC	DC
NOVA STS 15	37.5	53.0*
NOVA STS 27	45.0	63.6**
NOVA STS 38	52.5	74.2***

* Approximately 0.53 mA additional leakage current per phase with internal voltage sensors.
** Approximately 0.32 mA additional leakage current per phase with internal voltage sensors.
*** Approximately 0.37 mA additional leakage current per phase with internal voltage sensors.

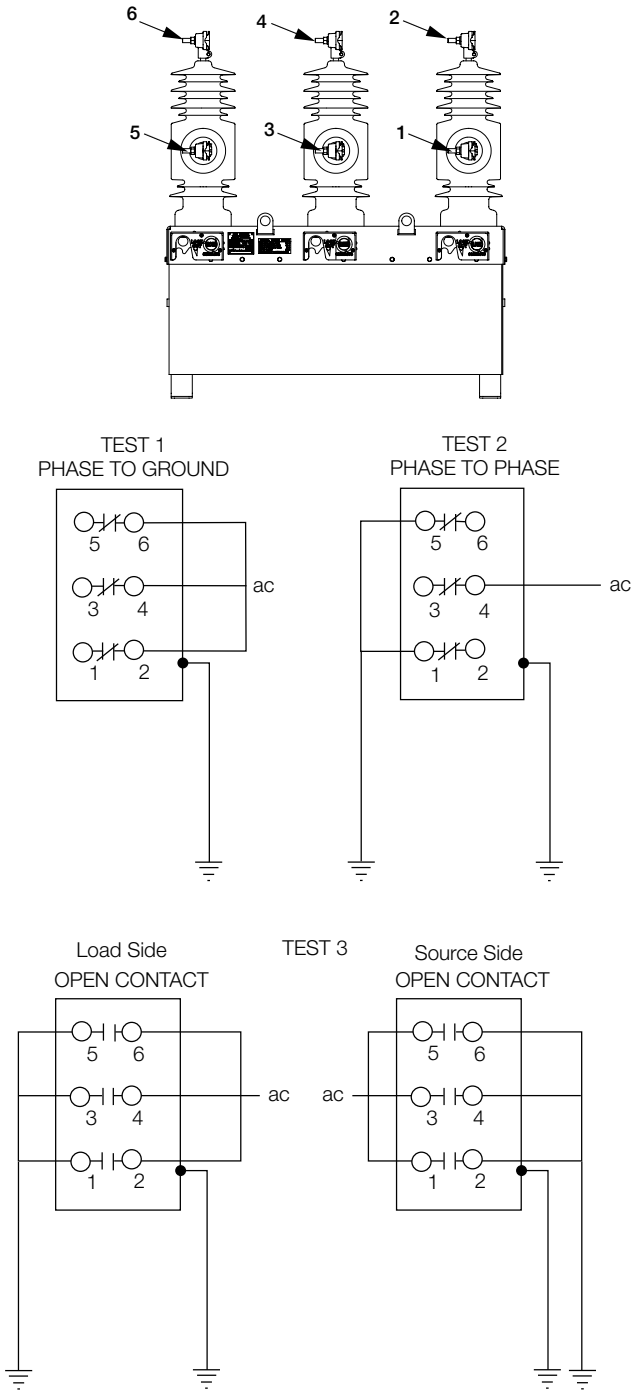


Figure 16. Terminal identification (top) and connection diagrams (bottom) for high-potential withstand testing.

Test results for NOVA STS reclosers equipped with the internal voltage sensing option will be influenced by the source-to-ground connected sensing resistor.

The following tests should be applied to the NOVA STS Single-Tank, Triple-Single recloser system:

Test 1

1. Close the recloser contacts.
2. Ground the recloser.
3. Connect terminals 2, 4, and 6 (see Figure 16) together.
4. Apply proper test voltage (see Table 15) to terminals 2, 4, and 6.
5. The recloser should withstand the test voltage for 60 seconds.

Test 2

1. Close the recloser contacts.
2. Ground the recloser.
3. Ground terminal 2 and terminal 6.
4. Apply proper test voltage to terminal 3.
5. The recloser should withstand the test voltage for 60 seconds.

Test 3

1. Open the recloser contacts.
2. Ground the recloser.
3. Connect and ground terminals 1, 3, and 5 (see Figure 16).
4. Connect terminals 2, 4, and 6.
5. Apply proper test voltage to terminals 2, 4, and 6.
6. The recloser should withstand the test voltage for 60 seconds.
7. Reverse the connections: ground terminals 2, 4, and 6.
8. Apply test voltage to terminals 1, 3, and 5 for 60 seconds.
9. The recloser should withstand the test voltage for 60 seconds.

Withstand test results

The high-potential withstand tests provide information on the dielectric condition of the recloser and the vacuum integrity of the interrupters.

If the recloser passes the closed-contacts tests (Tests 1 and 2), but fails the open-contacts test (Test 3), the cause is likely to be in the interrupter assembly. Retest each phase individually to determine the failed phase or phases.

If a recloser fails the closed-contacts test, the cause is likely to be a diminished electrical clearance or failed insulation.

If the recloser does not pass Tests 1, 2, or 3, contact an authorized service center or your Eaton's Cooper Power series product representative.

Note: Test results for NOVA reclosers equipped with the internal voltage sensing option will be influenced by the source-to-ground connected sensing resistor, especially if DC high-potential testing is performed.

Module flashover service

If a NOVA recloser module was exposed to an external flashover, an inspection process is recommended to assure proper operation of the recloser. Should the NOVA recloser exhibit external flashover attributes (carbon tracking or discoloration), the following procedure is recommended:

1. Bypass and remove the recloser from service as described in this manual.
2. Confirm the dielectric strength of the recloser by performing high-potential withstand test. Refer to the **High-potential withstand testing** section of this manual.
3. Inspect the housing and lifting lugs for damage that may affect electrical and/or mechanical performance. If there is damage to either the housing or lifting lugs they must be replaced or repaired.
4. Inspect module for damage to the terminals. Remove any damaged terminals and replace.
5. Inspect module for damage to the module conductor rods (0.63" diameter threaded rods on top and side of module for affixing terminals). If there is damage to the module rods, the module must be replaced. Contact an authorized service center or your Eaton's Cooper Power series representative.
6. Inspect the operating rod for damage. Check the module surface and major and minor sheds for cracks, holes, and major chips. If damage is present, the module must be replaced. Contact your Eaton's Cooper Power series product representative.
7. If no damage is found, clean the module with isopropyl alcohol and a scratch-free, nylon scouring pad to remove any carbon deposit.
8. Before returning to service confirm electrical operation by opening and closing the recloser with a control. Confirm the dielectric strength of the recloser by performing a high-potential withstand test. Refer to the **High-potential withstand testing** section of this manual.

Troubleshooting

If the NOVA STS recloser does not perform as described in the **Recloser operation** section of this manual, the following information may assist in troubleshooting:

Unit will not close

- Make sure the yellow manual operating handle is completely up (returned to the CLOSE position).
- Check all cables for proper connection.
- Check the condition of the battery located in the control cabinet. Refer to *Service Information S280-70-7 Form 6 Triple-Single, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* for the battery testing procedure.

Unit will not open

- Check all cables for proper connection.
- Check the condition of the battery located in the control cabinet. Refer to *Service Information S280-70-7 Form 6 Triple-Single, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* for the battery testing procedure.

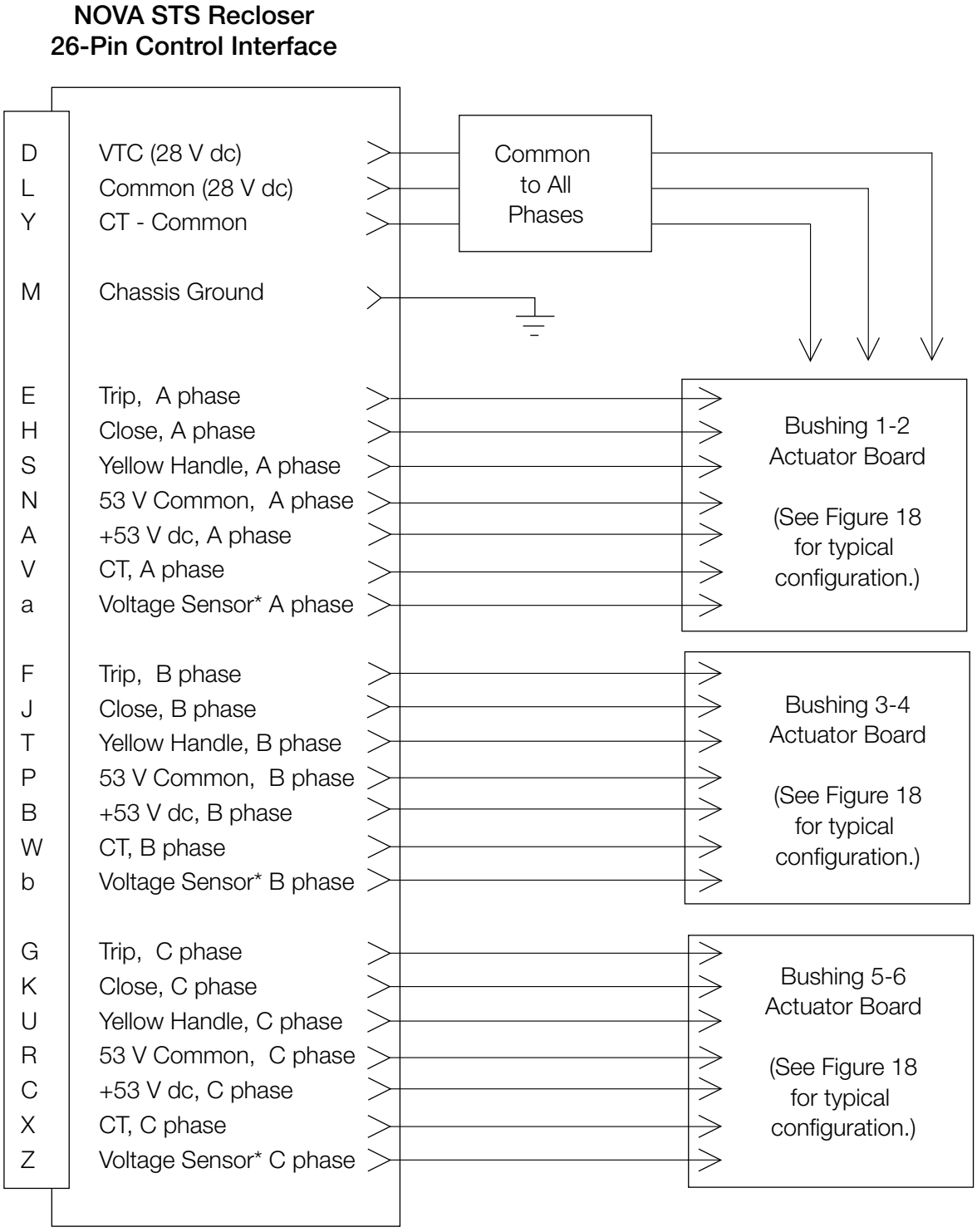


Figure 17. NOVA STS recloser and control connections.

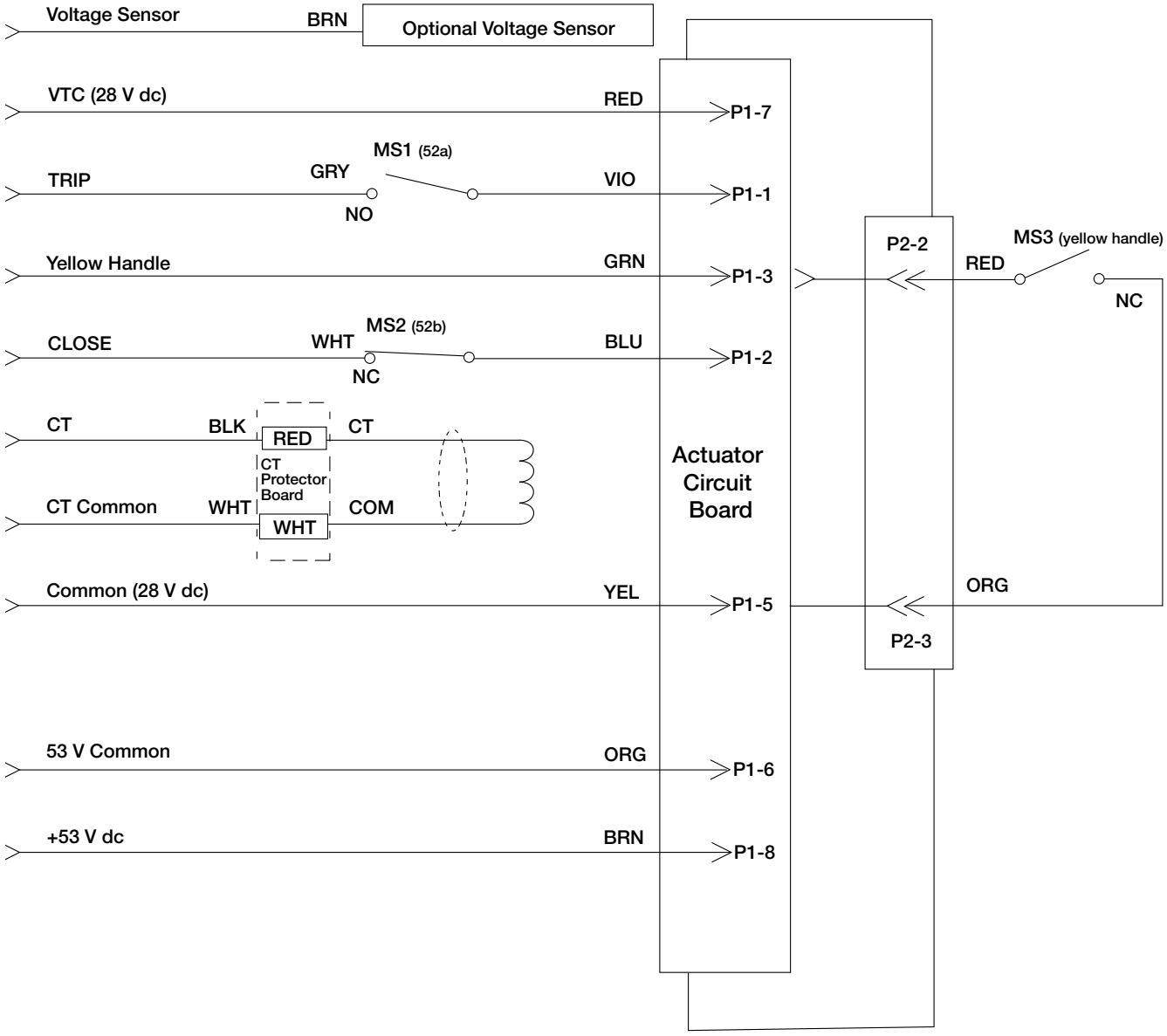
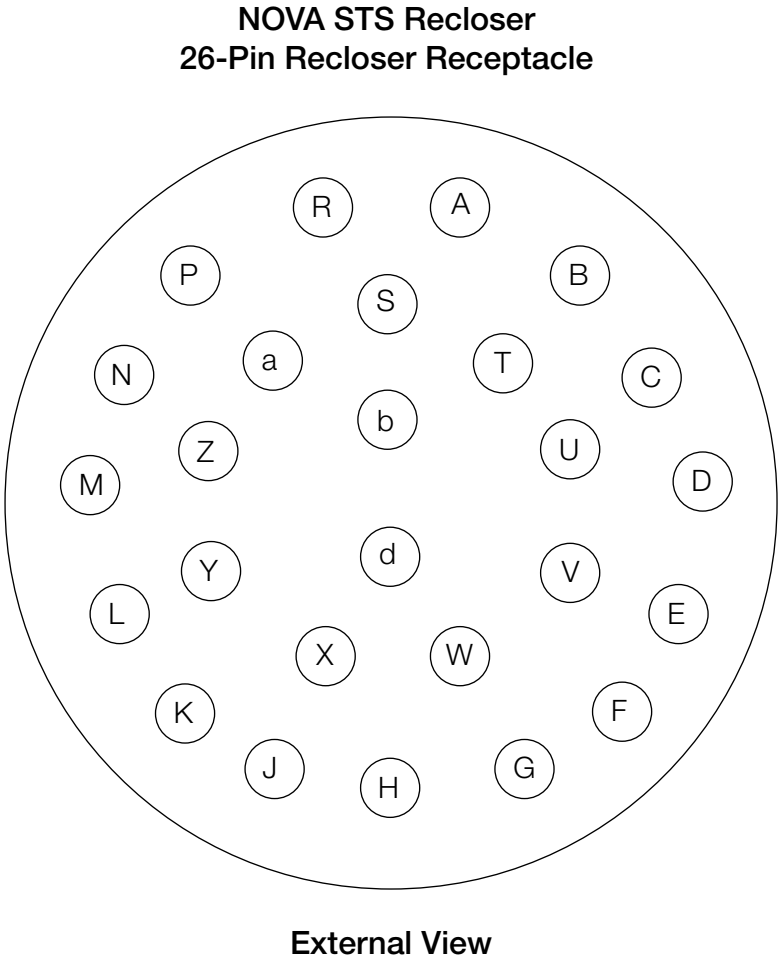


Figure 18. NOVA STS Triple-Single recloser internal wiring.



A	+53 V dc -AØ
B	+53 V dc -BØ
C	+53 V dc -CØ
D	VTC (28 V dc)
E	TRIP -AØ
F	TRIP -BØ
G	TRIP -CØ
H	CLOSE -AØ
J	CLOSE -BØ
K	CLOSE -CØ
L	Common (28 V dc)
M	Chassis Ground -AØ
N	53 V Common -AØ
P	53 V Common -BØ
R	53 V Common -CØ
S	Yellow Handle -AØ
T	Yellow Handle -BØ
U	Yellow Handle -CØ
V	CT -AØ
W	CT -BØ
X	CT -CØ
Y	CT -Common
Z	Opt. Voltage Sensor -CØ
a	Opt. Voltage Sensor -AØ
b	Opt. Voltage Sensor -BØ
d	N/C

Figure 19. NOVA STS Triple-Single recloser, pin identification.

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