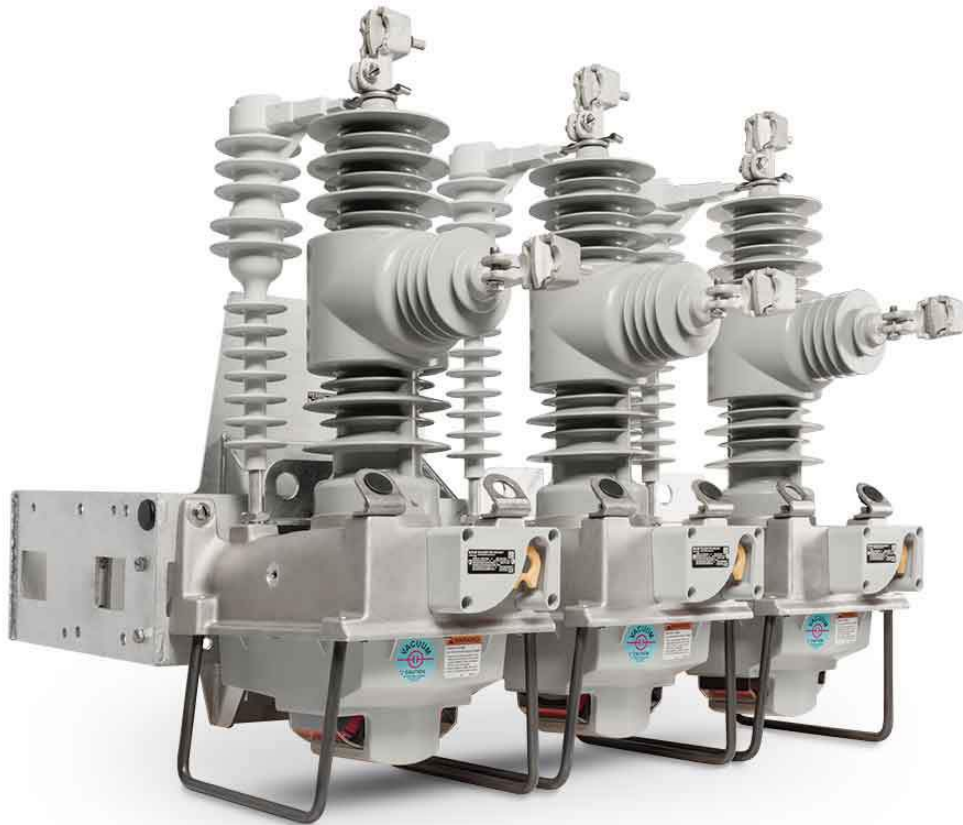


NOVA NX-T Recloser Installation and Operation Instructions



Powering Business Worldwide

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CONTENTS

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITY	ii
SAFETY FOR LIFE	iv
SAFETY INFORMATION	iv
Safety instructions	iv
PRODUCT INFORMATION	1
Introduction	1
Acceptance and initial inspection	1
Handling and storage	1
Standards	1
Quality standards	1
Description	1
RATINGS AND SPECIFICATIONS	2
INSTALLATION PROCEDURE	8
Removing recloser from service	10
RECLOSER OPERATION	11
Vacuum interrupter	11
Mechanism tripping and closing	11
Junction box	12
Electronic control	12
Manual Operation of Energized Recloser	12
3-phase trip/3-phase lockout or 1-phase trip/3-phase lockout	13
1-phase trip/1-phase lockout	13
Lockout indication	13
Automatic operation	13
Contact position indicator	13
Mechanical interlock feature	13
INTEGRATED VOLTAGE SENSING OPTION	13
ACCESSORIES	17
Auxiliary switch	17
Terminal options	17
Mounting hanger	17
Integrated voltage sensor option (6 sensors)	18
SERVICE INFORMATION	18
Service requirements	18
Frequency of inspection	18
High-potential withstand tests	18
Withstand test results	20
Troubleshooting	20



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.

NOTICE

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.

G122.2

Product information

Introduction

Eaton's *Service Information MN280087EN* provides installation, operation, and service instructions for its Cooper Power™ series NOVA NX-T 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 Eaton's Cooper Power series NX-T recloser control. Refer to *Service Information MN280088EN Form 6 NX-T, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* or *Service Information MN280089EN Form 6 NX-T/LS, Microprocessor-Based 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, please contact your Eaton 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 NOVA NX-T reclosers in the closed position to maximize the operational performance of the unit.

Standards

NOVA NX-T reclosers are designed and tested in accordance with:

- IEEE Std C37.60™–2012
- IEEE Std C37.90.1™–2012
- IEEE Std C37.90.2™–2004
- ANSI® C37.90–1989

Quality standards

ISO 9001 Certified Quality Management System

Description

The NOVA NX-T recloser system consists of three single-phase reclosers. Each recloser consists of an interrupting module, with an embedded current transformer, and mechanism mounted to an aluminum head casting. Each mechanism and interrupter assembly is mounted to a thermoset polymer enclosure suitable for pole or substation mounting. The interrupter modules utilize outdoor cycloaliphatic-epoxy-encapsulated vacuum interrupters.

The NOVA NX-T recloser system is 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 MN280088EN Form 6 NX-T, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* or *Service Information MN280089EN Form 6 NX-T/LS, Microprocessor-Based 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.

Table 1 through **Table 5** list the ratings and specifications for the NOVA NX-T recloser.

Table 1. Voltage ratings (kv)

Description	15 kV		27 kV		38 kV	
Rated Maximum Voltage (kV, rms)	15.5		27.0*		38.0	
Nominal System Voltage (kV, rms)	14.4		24.9		34.5	
	Std	Opt	Std	Opt	Std	Opt
Rated Short-Duration Power-Frequency Withstand Voltage (kV, rms)	50	50	60	60	70	70
Rated Lightning Impulse Withstand Voltage (kV, peak)	110	125	125	150	170	170

* Available with 29.3 kV rated maximum voltage. Short-circuit breaking current is limited to 12.5 kA in this rating configuration.

Table 2. Current ratings (amperes)

Description	15 kV		27 kV		38 kV	
	Std	Opt	Std	Opt	Std	Opt
Rated Continuous Current (A)	630	800	630	800	630	800
Rated Short-Time Withstand Circuit Current (kA)	12.5	16*	12.5	16*	12.5	12.5
Rated Peak Withstand Circuit Current (kA peak)	32.5	41.6	32.5	41.6	32.5	32.5
Rated Duration of Short-Circuit (s)	3	3	3	3	3	3
Rated Short-Circuit Breaking Current (kA, sym)	12.5	16	12.5	16	12.5	12.5
Rated Symmetrical (Short-Circuit) Making Current (kA, sym)	12.5	16	12.5	16	12.5	12.5
Rated Line Charging Interrupting Current (A)	2	2	5	5	5	5
Rated Cable Charging Interrupting Current (A)	10	10	25	25	40	40

* Available for 630 A or 800 A continuous rating option.

Table 3. Mechanical ratings

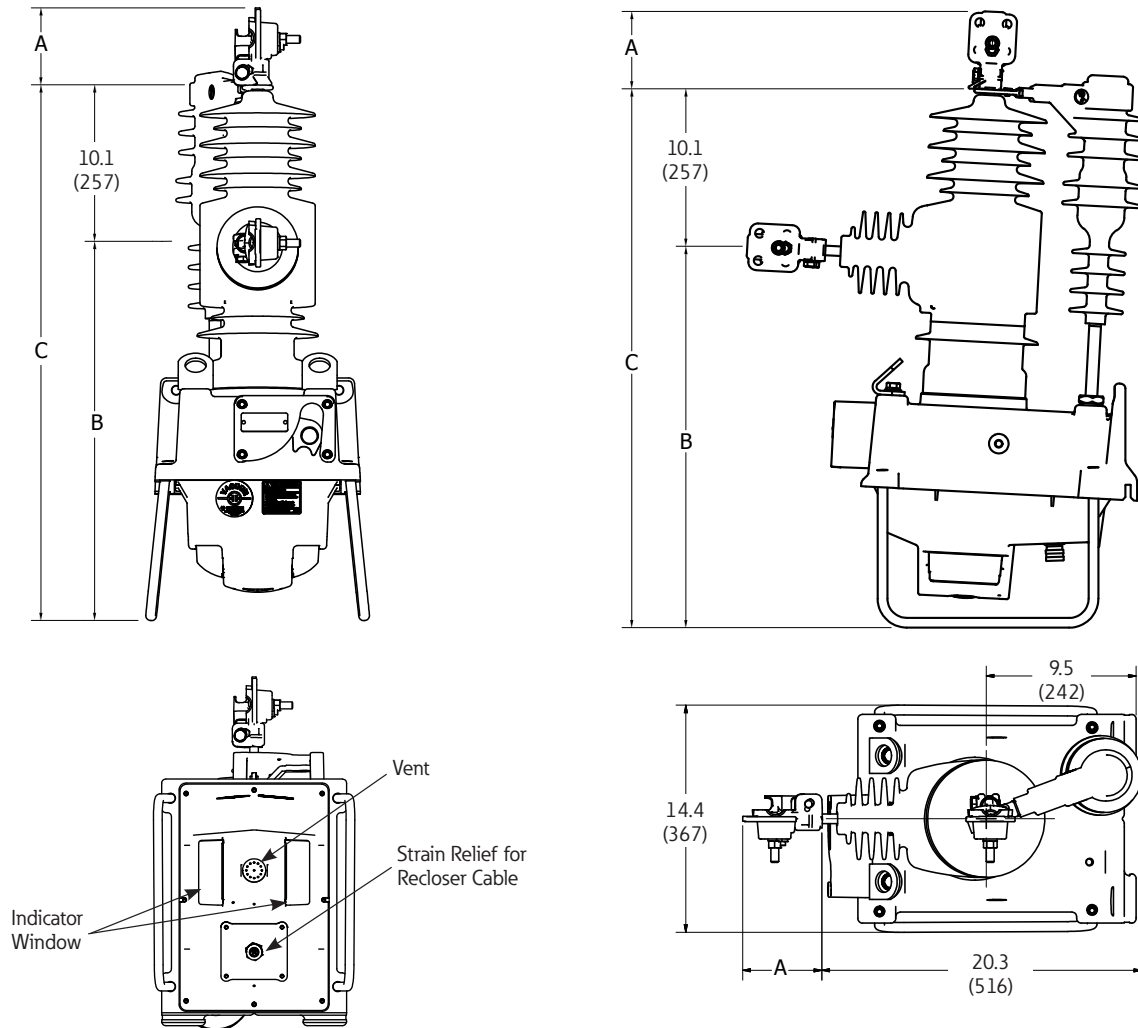
Description	15 kV (110 kV BIL)	15 kV (125 kV BIL)	27 kV (125 kV BIL)	27 kV (150 kV BIL)	38 kV (170 kV BIL)
Min. Mechanical/Electrical Operations Without Maintenance (C-O)	10,000	10,000	10,000	10,000	10,000
Mass (Weight) - kg (lbs), 1-ph recloser	45 (100)	50 (110)	50 (110)	54 (120)	54 (120)
Mass (Weight) - kg (lbs), 3-ph reclosers with frame	213 (470)	227 (500)	227 (500)	240 (530)	240 (530)

Table 4. Duty cycle

Type	Percentage of Maximum Circuit Interrupting Rating	Minimum X/R Ratio	Number of Unit Operations at 12.5 kA	Number of Unit Operations at 16.0 kA
NOVA NX-T	15-20	4	88	88
	45-55	8	112	112
	90-105	17	32	32
			Total 232	Total 232

Table 5. Auxiliary switch ratings

Volts	Amperes
Up to 30 Vdc	5 A
Up to 250 Vac	5 A
Minimum applicable load	0.16 A @ 5.0 Vdc



Terminal Option Type	A in. (mm)
Eyebolt - (630 A) 1/0 to 500 MCM Cable Range	3.25 (80)
Eyebolt - (800 A) 4/0 to 1000 MCM Cable Range	4.25 (108)
Flat Pad - 2-hole (630 A max)	4.5 (114)
Flat Pad - 4-hole (800 A max)	4.75 (121)

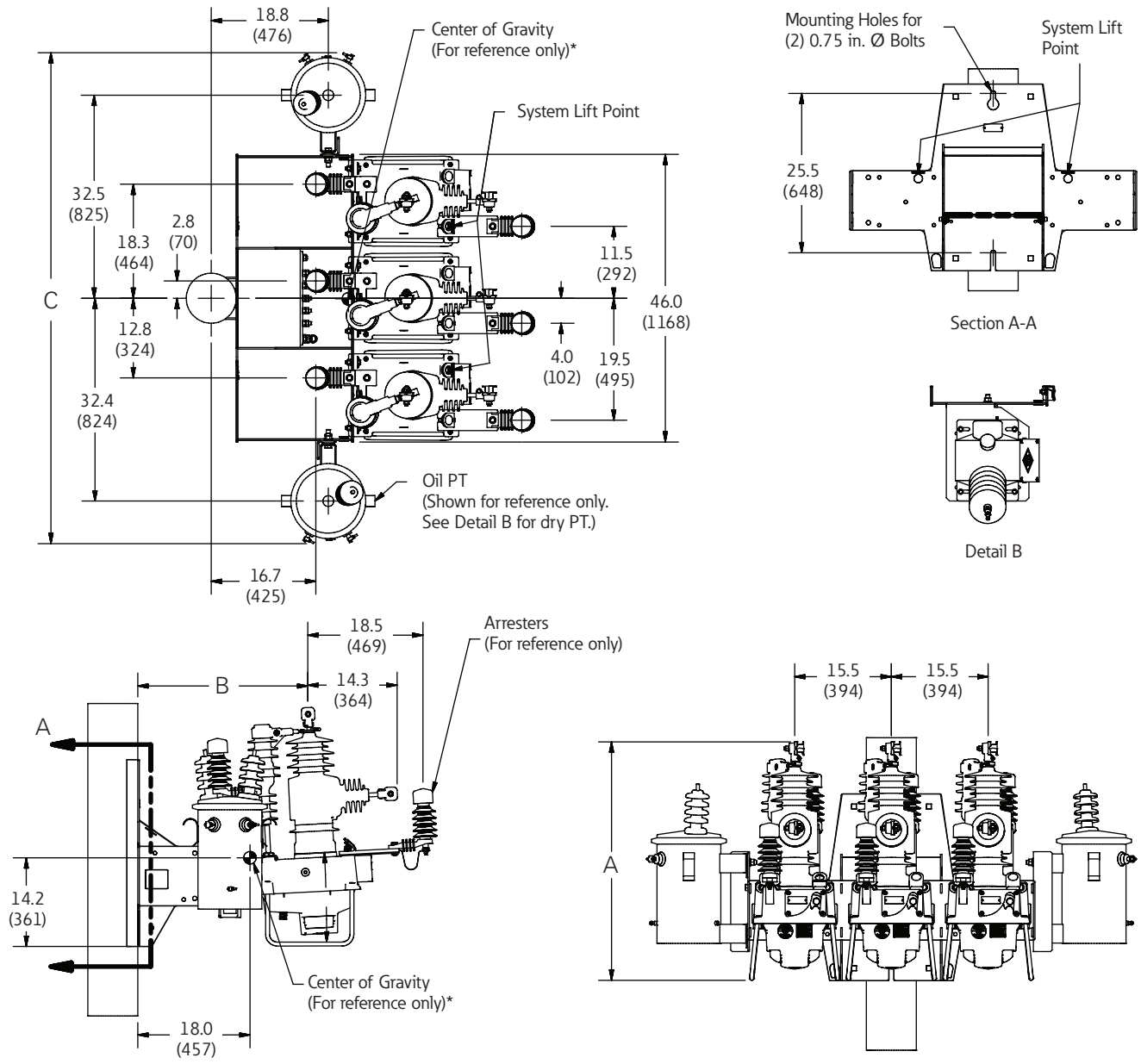
Note: All dimensions are inches (mm). Dimensions shown are approximate.

	B in. (mm)	C in. (mm)
NOVA NX-T 15 (110 kV BIL)	24.1 (612)	35.0 (889)
NOVA NX-T 15 (125 kV BIL)	26.3 (668)	37.2 (945)
NOVA NX-T 27 (125 kV BIL)	26.3 (668)	37.2 (945)
NOVA NX-T 27 (150 kV BIL)	30.2 (767)	41.1 (1044)
NOVA NX-T 38 (170 kV BIL)	30.2 (767)	41.1 (1044)

Rating - Creepage Distances	15 kV in. (mm)	27 kV in. (mm)	38 kV in. (mm)
Terminal to terminal	41.5 (1052)	41.5 (1052)	41.5 (1052)
Lower terminal to ground	26.5 (673)	30.5 (775)	38.6 (980)

Figure 1. NOVA NX-T individual recloser dimensions

NOVA NX-T Recloser



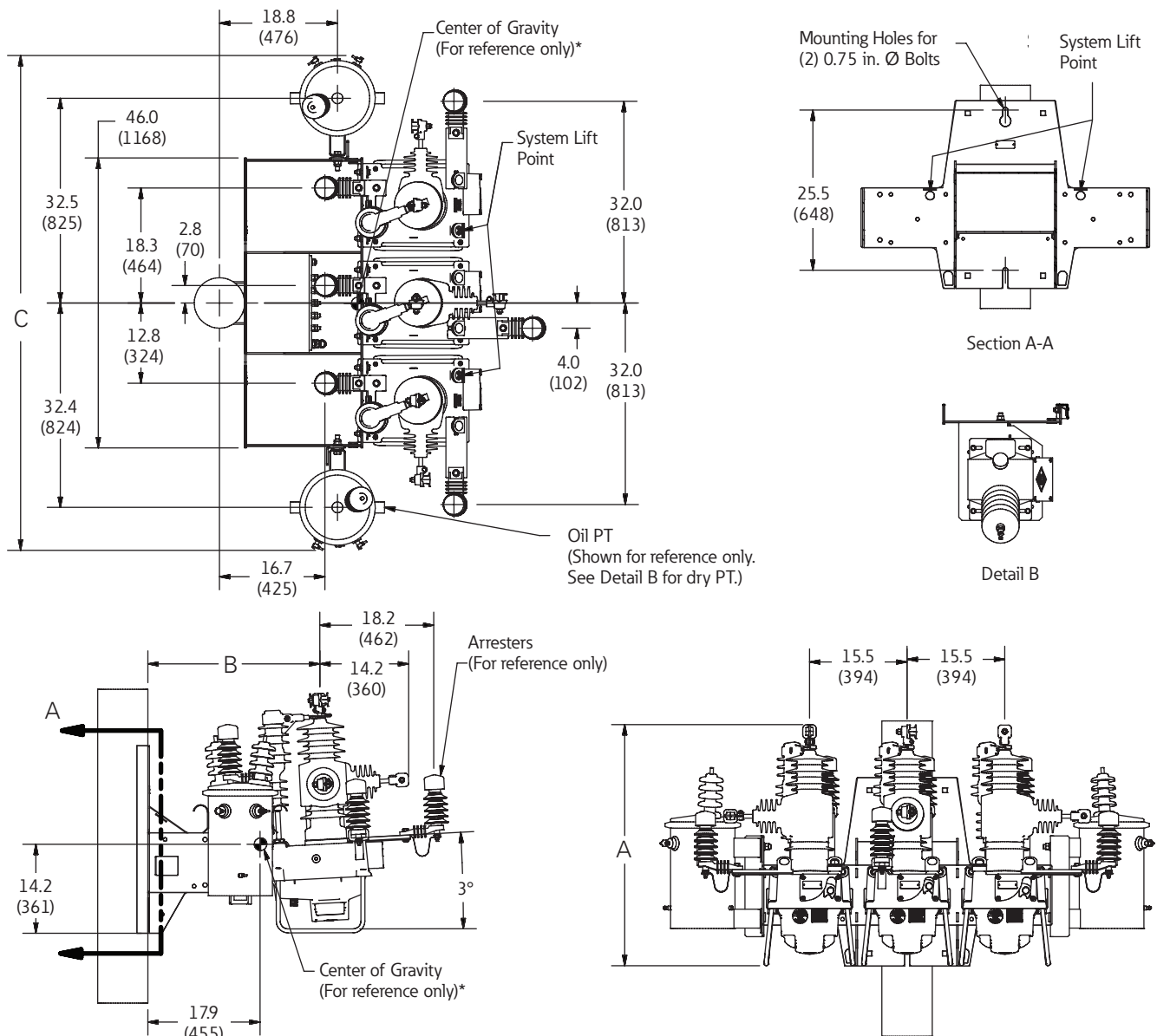
kV Rating	A in. (mm)	B in. (mm)
15.5 (110 kV BIL)	38.2 (969)	27.6 (701)
15.5 (125 kV BIL)	40.4 (1025)	27.5 (698)
27.0 (125 kV BIL)	40.4 (1025)	27.5 (698)
27.0 (150 kV BIL)	44.3 (1124)	27.3 (692)
38.0 (170 kV BIL)	44.3 (1124)	27.3 (692)

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

* Center of gravity does not include PT and arrester mass.

PT Type	C in. (mm)
OIL	78.5 (1994)
DRY	83.6 (2124)

Figure 2. NOVA NX-T in-line parallel site-ready configuration



kV Rating	A in. (mm)	B in. (mm)
15.5 (110 kV BIL)	38.2 (969)	27.6 (701)
15.5 (125 kV BIL)	40.4 (1025)	27.5 (698)
27.0 (125 kV BIL)	40.4 (1025)	27.5 (698)
27.0 (150 kV BIL)	44.2 (1124)	27.3 (694)
38.0 (170 kV BIL)*	—	—

* Contact factory if required

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

PT Type	C in. (mm)
OIL	78.5 (1994)
DRY	83.6 (2124)

* Center of gravity does not include PT and arrester mass.

Figure 3. NOVA NX-T in-line perpendicular site-ready configuration

NOVA NX-T Recloser

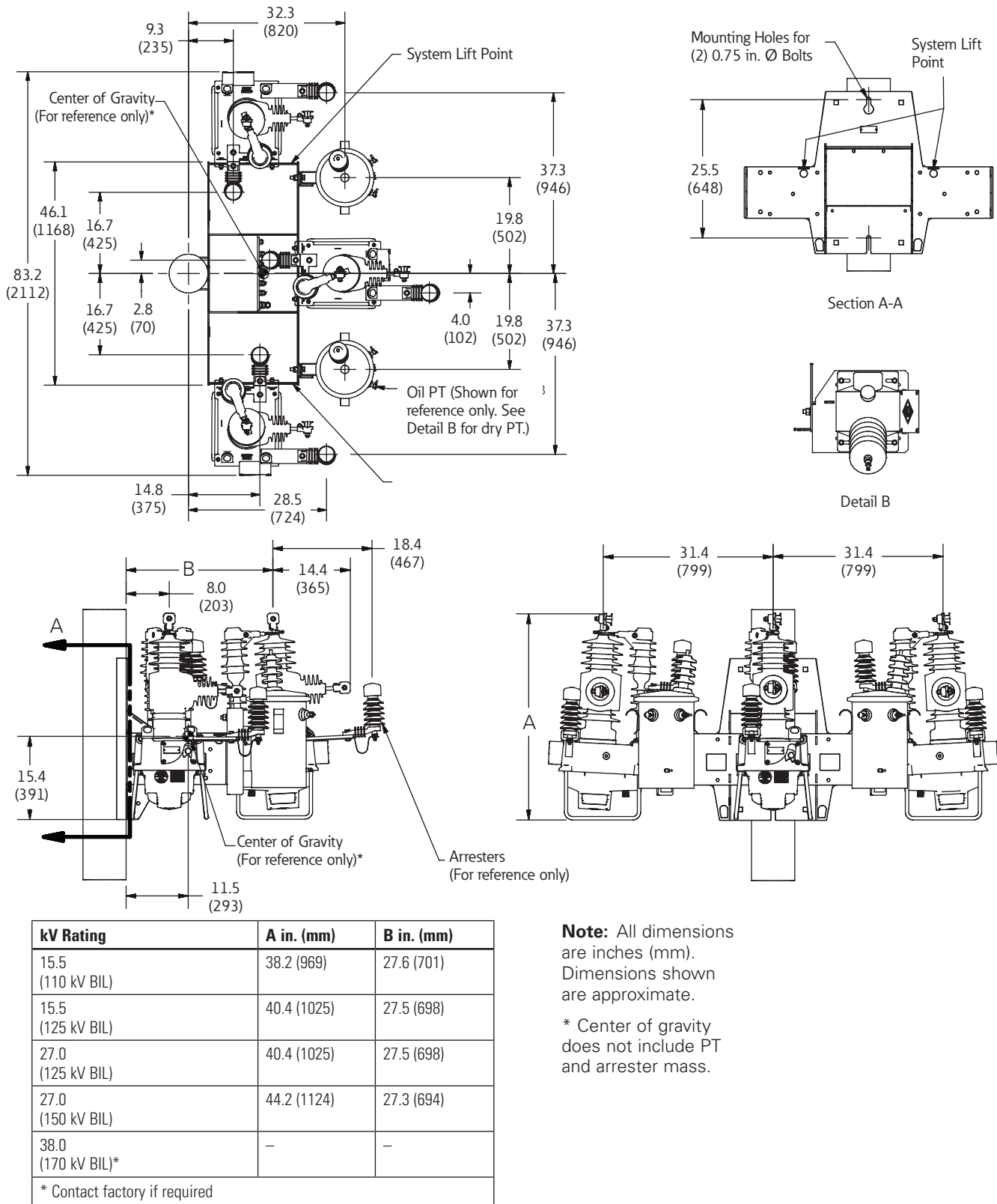


Figure 4. NOVA NX-T tri-mount parallel site-ready configuration

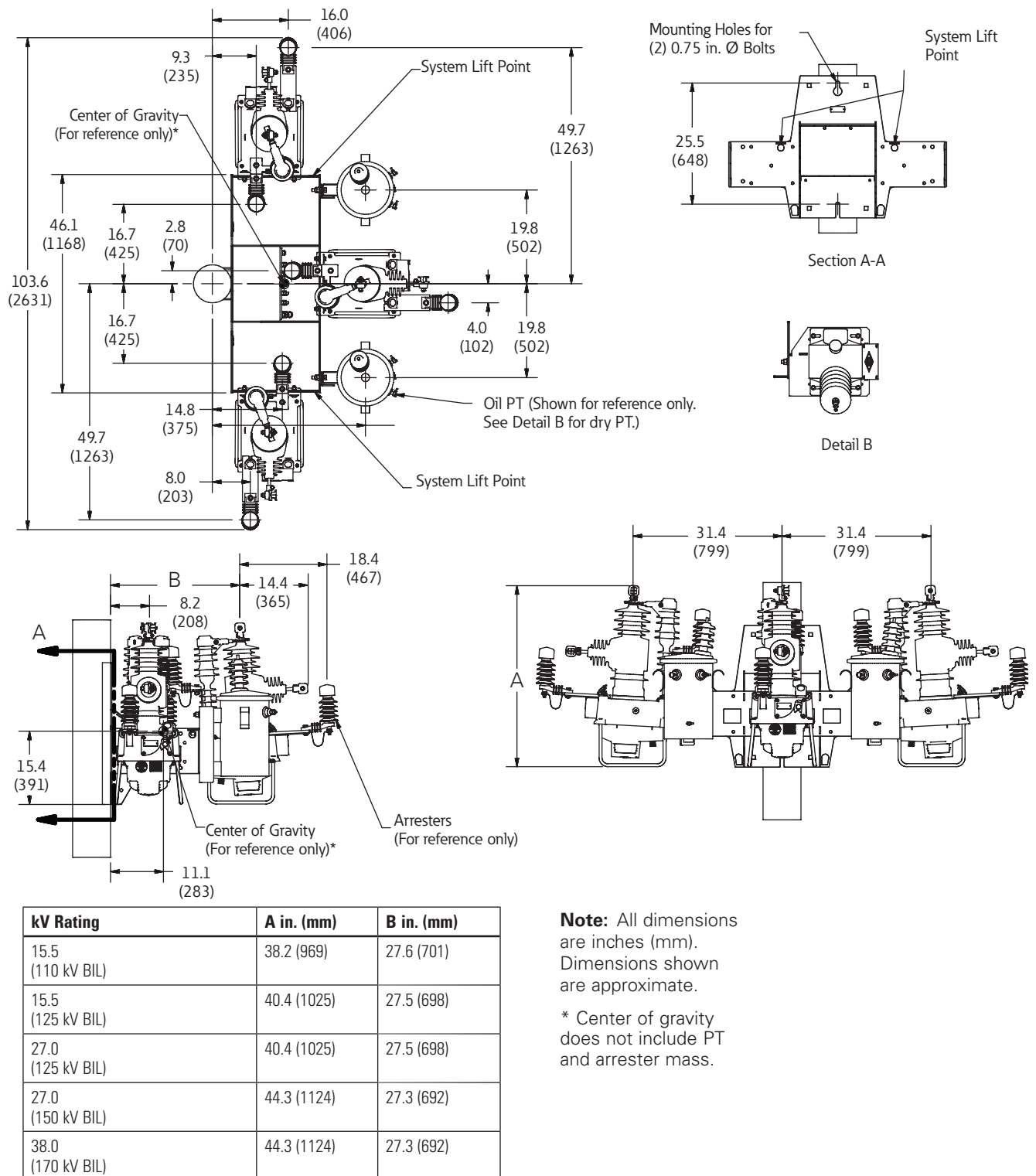


Figure 5. NOVA NX-T tri-mount perpendicular site-ready configuration

Installation procedure

⚠ 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

All reclosers are carefully tested and adjusted at the factory to operate according to published data. Well-equipped test facilities, detailed testing procedures, and thoroughly trained personnel assure accurately calibrated equipment. Each recloser leaves the factory ready for installation—pending completion of the steps in this procedure.

Eaton recommends transporting NOVA NX-T reclosers in the closed position to maximize the operational performance of the unit.



Figure 6. NOVA NX-T recloser data plates are located on the sleet hood

1. Check the data plate ratings. Make sure the ratings on each recloser data plate (see **Figure 6**) are correct for the planned installation.
2. Perform high-potential withstand tests. Prior to installing the NOVA NX-T recloser, perform high-potential withstand tests on each of the three single-phase reclosers. Refer to the **High-potential withstand tests** section of this manual 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.

⚠ 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

⚠ 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. Mount the reclosers. Use the lifting lugs (identified with a label SYSTEM LIFT) located on the head casting and/or on the frame, and follow approved procedures. See **Figure 2** through **Figure 5** for lifting lug locations. At this point, the contacts are open, the bypass switches are closed, and the disconnect switches are open.

IMPORTANT

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

If equipped with source voltage sensors only, then the horizontal bushings must be connected to the source. The source voltage sensors cannot monitor source-side voltage when the NOVA NX-T recloser is in the OPEN position if the horizontal bushings are connected to the load. To monitor source and load side voltages, ensure the recloser is equipped with the source and load side voltage sensing accessory.

⚠ WARNING

Hazardous voltage. If terminal connections are reversed, voltage sensing may indicate erroneous voltages when the contacts are open. Do not rely on 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

WARNING

Hazardous voltage. Recloser and control must be solidly grounded. Follow all locally approved procedures and safety practices when grounding this equipment. Improper grounding can result in contact with high voltage, which will cause death or severe personal injury.

G115.1

- Ground the reclosers. Make ground connections to the ground terminal on the pole mount frame. The ground terminal will accommodate #2 solid to 500 MCM stranded conductors.

This recloser is used in conjunction with Eaton's Cooper Power series type Form 6 NX-T control. Refer to *Service Information MN280088EN Form 6 NX-T, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* or *Service Information MN280089EN Form 6 NX-T/LS, Microprocessor-Based Recloser Control Installation and Operation Instructions* for comprehensive recommended grounding instructions.

- Each recloser shall have a ground wire from the aluminum tank to a ground terminal on the pole mount frame. If a ground braid accessory was not ordered, then attach a #10 – #2 ground wire between the ground terminal provided on the side of the recloser aluminum tank and the ground terminal provided on the pole mount frame.

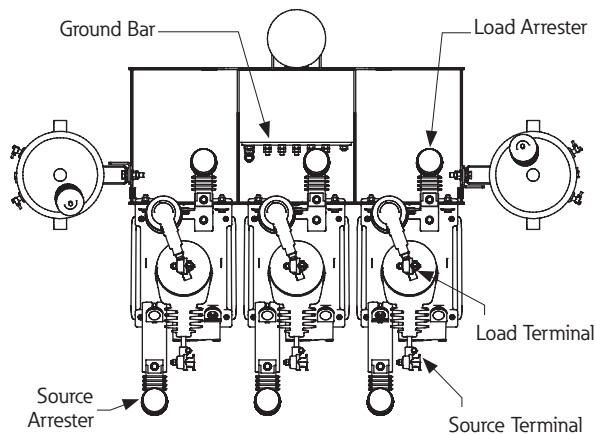


Figure 7. Example site ready configuration (in-line parallel) showcasing source and load side bushings

- Install the control. Refer to *Service Information MN280088EN Form 6 NX-T, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* or *Service Information MN280089EN Form 6 NX-T/LS, Microprocessor-Based Recloser Control Installation and Operation Instructions*. Connect the control cable between the control and the frame receptacle panel (located underneath the frame). Reclosers will have each individual recloser junction box cable pre-connected at the factory. Make sure the control is grounded and properly programmed for the planned installation.

WARNING

Hazardous voltage. Do not touch the pins inside the control cable connector. Pins could be energized if a trip or close signal is issued. Failure to comply could cause severe injury or death.

Note: Control is interlocked such that during normal operation, voltage cannot appear unless correct 52a/b status is reported by the recloser.

To ensure proper installation of this cable, securely mate the cable to its mating receptacle by first aligning the blue indicator on the cable to the respective blue indicator on the receptacle. Mate the cable, and twist one quarter turn until the twist lock connector seats in place. While fastening the cable connector, a red ring below the cable collar will be covered, and an audible click can be heard during the locking process.

(Figure 8).



Figure 8. Cable with twist lock connector

- Make the high-voltage line connections. See **Figure 9**.

Note: Disconnect switches and bypass switches are recommended to facilitate switching and isolation.

- Provide surge protection to both sides of each recloser.

NOTICE

Equipment damage. Do not adjust or rotate bushing terminals without first removing power line leads and loosening pinch bolt to release clamp tension. Failure to remove tension between the clamp and the interrupter stud prior to rotating the terminal will damage the encapsulated interrupter assembly resulting in equipment damage.

NOTICE

Equipment damage may occur if torque values are exceeded.

T370.0

- Connect high-voltage lines to recloser bushing terminals. The recommended torque value for bushing terminal-to-line connection is 45-50 ft•lbs.

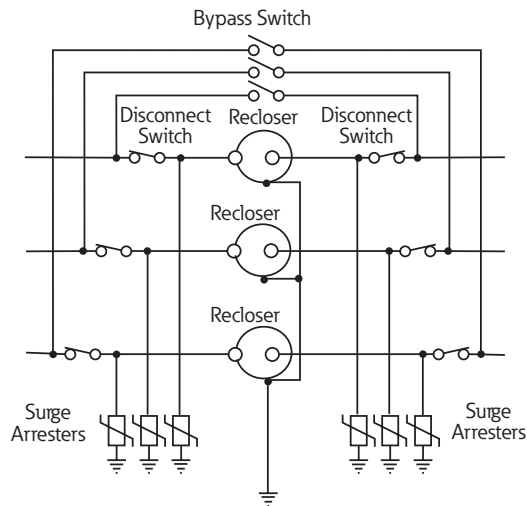


Figure 9. Connection diagram shows complete surge protection and illustrates bypass and disconnect switches

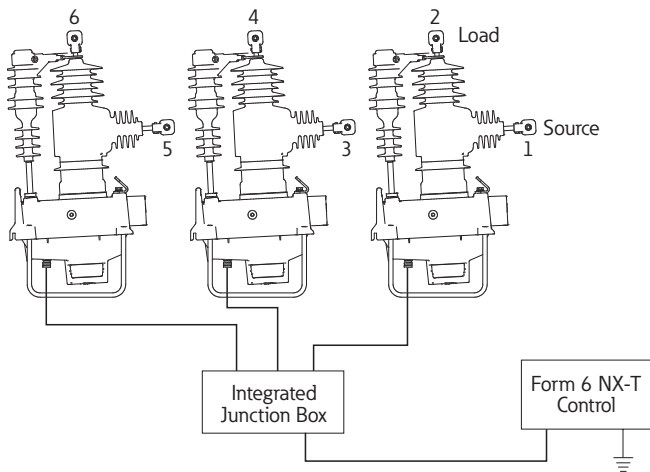


Figure 10. Terminal identification of Type NOVA NX-T recloser

Refer to **Figure 7** and **Figure 10** for terminal identification of the NOVA NX-T 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).

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

Removing 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 MN280088EN Form 6 NX-T, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* or *Service Information MN280089EN Form 6 NX-T/LS, Microprocessor-Based Recloser Control Installation and Operation Instructions*.

NOTICE

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. Pull down the yellow operating handle with a hotstick. The yellow operating handle is 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.

The control will sense that the recloser(s) are open.

4. Open the source and load disconnect switches.

IMPORTANT

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

5. Disconnect the control battery.

⚠ WARNING

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. Failure to comply could cause death or severe personal injury. T204.3

⚠ WARNING

Hazardous voltage. Do not touch the pins inside the control cable connector. Pins could be energized if a trip or close signal is issued. Failure to comply could cause severe injury or death.

6. Remove the control AC sensing and power connections from the control using a separate disconnect switch.
7. Disconnect the control cable from the recloser.

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

8. Follow standard utility procedures regarding removal of recloser from service.
 - Eaton recommends transporting NOVA NX-T reclosers in the closed position to maximize the operational performance of the unit.

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 NOVA NX-T recloser and inputs this information to the NX-T 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 MN280088EN Form 6 NX-T, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* or *Service Information MN280089EN Form 6 NX-T/LS, Microprocessor-Based Recloser Control Installation and Operation Instructions* for control operation information.

Vacuum interrupter

Arc interruption takes place within the sealed vacuum interrupter. Eaton's 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 NX-T recloser system is comprised of three single-phase NOVA NX-T 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 a single coil (used for trip or close) that provides the energy to operate the mechanism.

To open the main contacts, the 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.

Trip/close capacitors (in the control) store the necessary energy for operating the recloser. The capacitors have been sized to ensure trip energy is available following any close operation. The charging of these capacitors occurs within

NOVA NX-T Recloser

the control – no capacitors are present in the recloser.

Junction box

The NOVA NX-T recloser uses an integrated junction box that is part of the pole mount frame. A receptacle panel is located underneath the frame and has A, B, and C phase label designations for each junction box receptacle. The sloped roof of the integrated junction box shields the junction box and control cabling from external weather elements. The control cable and the interconnecting cable from each NOVA NX-T individual phase unit connects to the receptacle panel using a Breech-Lok™ twist lock connector.

Refer to *Service Information MN280088EN Form 6 NX-T, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* or *Service Information MN280089EN Form 6 NX-T/LS, Microprocessor-Based Recloser Control Installation and Operation Instructions* for junction box information.

Electronic control

Refer to *Service Information MN280088EN Form 6 NX-T, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* or *Service Information MN280089EN Form 6 NX-T/LS, Microprocessor-Based 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; 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.

G116.0

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

Do not hold the yellow handle while issuing an electrical close operation from the control. If the handle is held in an intermediate state, the electrical close operation could drive it upward creating a pinch point between the handle and the sleet hood.

The recloser mode of operation determines which units open and close. The Form 6 NX-T control initiates the close signal. Refer to *Service Information MN280088EN Form 6 NX-T, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* or *Service Information MN280089EN Form 6 NX-T/LS, Microprocessor-Based 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 11**. 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 located on the bottom of the recloser. 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 NX-T 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 NX-T control.



Figure 11. NOVA NX-T recloser operating levers and position indicators

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 units will lock out when the yellow operating handle on one unit 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 unit with the yellow handle pulled down to the OPEN position will lock out. The other two units will not be affected and their yellow operating handles will remain in the CLOSED position.

Lockout indication

Lockout is indicated by the Form 6 NX-T 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 NX-T recloser, in the CLOSED position, operates automatically per the control-programmed settings.

Contact position indicator

Located on the bottom of the recloser within the thermoset polymer housing, this indicator displays the word OPEN (Green) when the recloser contacts are open and CLOSED (Red) when the recloser contacts are closed. The position indicator is reflective and can be seen at night when a flashlight is shown on its surface. See **Figure 11**.

Mechanical interlock feature

NOVA NX-T uses a mechanical interlock safety feature that is standard for all NOVA NX-T reclosers to prevent an undesired close. When the yellow handle is pulled down from underneath the sleet hood, the mechanical interlock is engaged within the recloser tank and physically prevents the recloser contacts from closing. The mechanical interlock is disengaged when the yellow handle is moved upwards into the sleet hood and the recloser can now be electrically closed.

Integrated 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

WARNING

Hazardous voltage. If terminal connections are reversed, voltage sensing may indicate erroneous voltages when the contacts are open. Do not rely on 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

IMPORTANT

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

The NOVA NX-T is available with three or six voltage sensors (three internal for source voltage sensing, three integral sensors for load side voltage sensing) when specified at time of order with the Form 6 NX-T control. Refer to the **Installation procedure** section of this manual for information on the NOVA NX-T recloser installation procedure. Refer to *Service Information MN280088EN Form 6 NX-T Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* for further information on installing the Form 6 NX-T pole-mount control.

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

NOTICE

When the load side voltage sensor accessory is installed, do not grasp the top of the load side voltage sensor and lift. Doing so can cause internal damage to the load side voltage sensor and affect voltage sensing accuracy. On the side of the load side voltage sensor is a "do not lift" symbol for visual warning.

See **Figure 12** for a close up of "do not lift" symbol imprinted on the side of the load side voltage sensor.

NOVA NX-T Recloser



Figure 12. "Do not lift" symbol printed on the side of the load side voltage sensor

Verify correct ground of the NOVA NX-T reclosers 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: 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 voltage sensing options (source and/or load side voltage sensors).

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 reclosers utilize the standard 18-pin junction-box cables and 37-pin control cable to carry the source and integrated load side voltage sensing signals from the recloser to the control. Additional voltage sensing cables are not required when using the voltage sensing feature for source and load. There are no additional custom connections required.

NOTICE

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 integrated 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 13**. 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 NX-T control must be programmed with a PT ratio and a phase angle adjustment; refer to **Table 6** and **Table 7**. These are entered in the System Configuration screen; see **Figure 14**.

When programming the Form 6 NX-T control, the PT connection must be set for a wye connection. Also, the Phantom Phase feature must be disabled. Refer to Service Information MN280088EN Form 6 NX-T, Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions for more information on installing the Form 6 NX-T control.

Table 6. PT ratio for Form 6 NX-T

Voltage Class	Source Side (Side Arm) Ratio	Load Side (Top) Ratio
15.5 kV	1476:1	1476:1
15.5 kV Extra Creep	1476:1	1476:1
27 kV	2955:1	2955:1
27 kV Extra Creep	2955:1	2955:1
38 kV	2955:1	2955:1

Table 7. Phase Angle Adjustment for Form 6 NX-T

Cable Length (ft.)	15.5 kV Phase Angle Correction		15.5 kV Extra Creep Phase Angle Correction		27 kV Phase Angle Correction		27 kV Extra Creep Phase Angle Correction		38 kV Phase Angle Correction	
	Source	Load	Source	Load	Source	Load	Source	Load	Source	Load
10	2.47°	2.5°	3.47°	2.5°	5.21°	2.16°	6.63°	2.16°	6.63°	2.16°
20	3.22°	3.25°	4.22°	3.25°	5.96°	2.91°	7.38°	2.91°	7.38°	2.91°
30	3.97°	4°	4.97°	4°	6.71°	3.66°	8.13°	3.66°	8.13°	3.66°
40	4.72°	4.75°	5.72°	4.75°	7.46°	4.41°	8.88°	4.41°	8.88°	4.41°
50	5.47°	5.5°	6.47°	5.5°	8.21°	5.16°	9.63°	5.16°	9.63°	5.16°
60	6.22°	6.25°	7.22°	6.25°	8.96°	5.91°	10.38°	5.91°	10.38°	5.91°
70	6.97°	7°	7.97°	7°	9.71°	6.66°	11.13°	6.66°	11.13°	6.66°
80	7.72°	7.75°	8.72°	7.75°	10.46°	7.41°	11.88°	7.41°	11.88°	7.41°
90	8.47°	8.5°	9.47°	8.5°	11.21°	8.16°	12.63°	8.16°	12.63°	8.16°

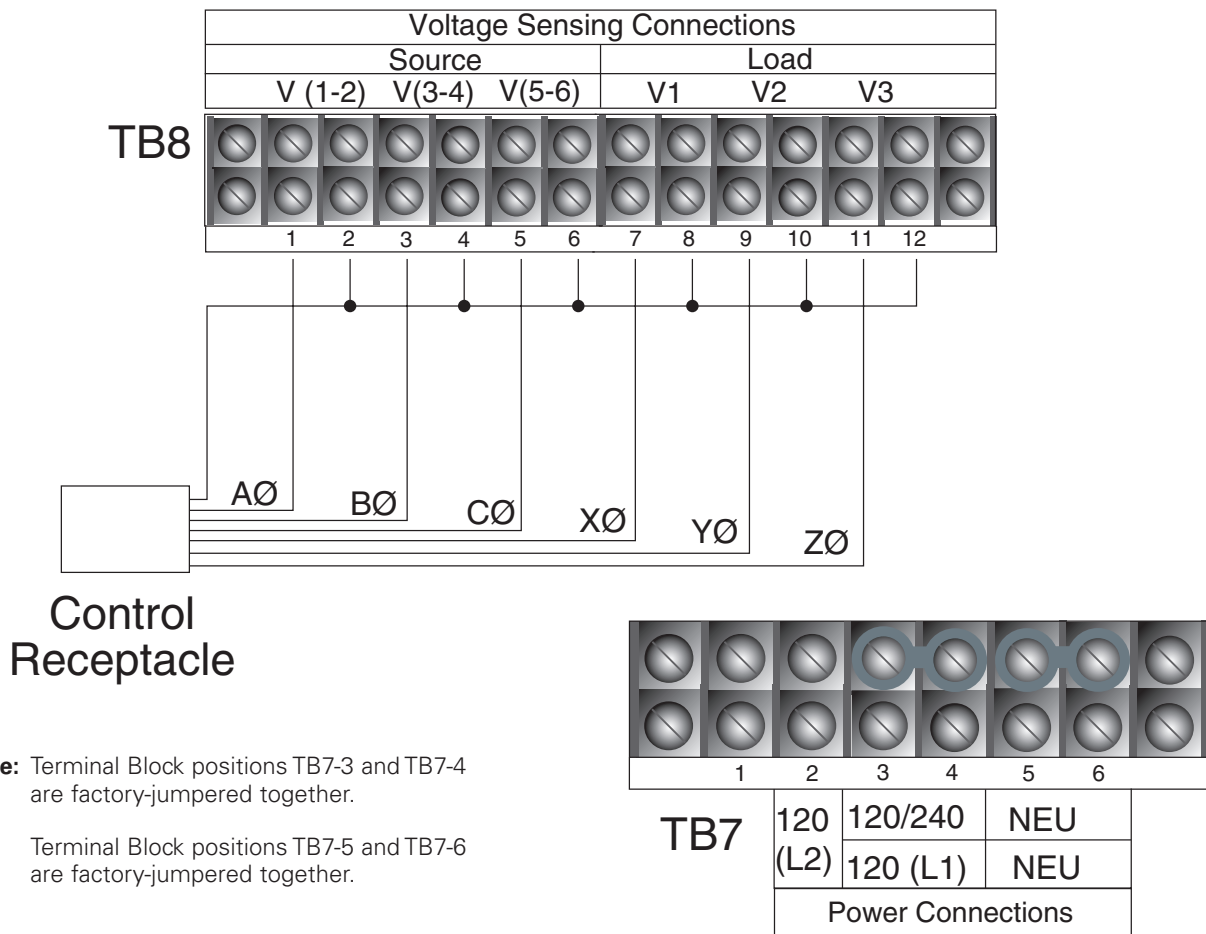


Figure 13. Default factory wiring for voltage sensor options (source and load)

⚠ 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 the reclosers. Energize reclosers 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

Voltage sensing outputs are maintained at 8 V maximum when the recloser is energized, though system faults or improper grounding may lead to higher voltages present. Current sensing outputs are clamped at 250 Vac when the control cable is disconnected. Do not touch the female receptacle connections of the control/voltage sensing cable.

System Configuration

[See also the Load-Side PT Configuration settings]

System Configuration

Feeder Description

System Frequency (Hz) CT Ratio (x:1)

	A:AB	B:BC	C:CA
PT Ratio (x:1)	<input type="text" value="1476"/>	<input type="text" value="1476"/>	<input type="text" value="1476"/>
Adjust (deg)	<input type="text" value="3.97"/>	<input type="text" value="3.97"/>	<input type="text" value="3.97"/>

V expected (kV pri)

Pole Mounted Control V present (kV pri)

Swap to Primary Voltage

System Zero-Seq. Source Impedance in Ohms (pri)

Zero-Seq Source Impedance + j

Fault Locator

Positive Sequence Line Impedance + j Ohms (pri)

Zero Sequence Line Impedance + j Ohms (pri)

Line Length Miles

Manual close time delay Seconds Duty Cycle Factor (10⁵)

Do not Allow Manual Close Delay Override

Potential Transformer Correction Angle, C-phase (deg), MIN = -180, MAX = 180

Indicate PT Connection: Wye or Delta

Bushing Configuration [Wye/Delta]

A/AB	B/BC	C/CA
X/XY	Y/YZ	Z/ZX
<input type="text" value="1-2"/>	<input type="text" value="3-4"/>	<input type="text" value="5-6"/>

System Rotation

Connected PT's [Wye/Delta]

A/AB PT Connected

B/BC PT Connected

C/CA PT Connected

Help Cancel OK

Figure 14. Form 6 NX-T system configuration screen representation for a 15 kV system

Accessories

Auxiliary switch

A single-stage auxiliary switch can be provided as an accessory. The auxiliary switch has two independent contacts: a single "a" contact (follows state of recloser contacts) and a single "b" contact (opposite recloser contacts). This accessory allows for remote monitoring of the recloser.

The switch contacts are insulated for 250 Vac and have a continuous current rating of 5 A. The interrupting ratings are shown in **Table 8**.

Table 8. Auxiliary switch ratings

Volts	Amperes
Up to 30 Vdc	5 A
Up to 250 Vac	5 A
Minimum applicable load	0.16 A @ 5.0 Vdc

Table 9. Auxiliary switch pin contacts and cable wire colors

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

* Wire color of the factory-supplied cable accessory.

Terminal options

NOVA NX-T reclosers can be specified with eyebolt terminals (630 A and 800 A), two-hole (630 A) or four-hole (800 A) flat-pad terminals.

The eyebolt and flat-pad 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 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.

Mounting hanger

Pole-mounting accessory

One pole-mounting hanger, which allows a variety of recloser mounting configurations (and PTs), is available for pole-mount installations for wood or concrete poles. Refer to **Figure 2** for a representation of this bracket.

Arrester mounting brackets

Each phase of the NOVA NX-T recloser has three (3) mounting locations available on the tank head to mount a source side arrester bracket. A load side bracket is also available which mounts behind the NOVA NX-T bushing module. The arrester brackets can be factory or field installed. If installed at the factory, optional arresters can be factory installed with phase and/or ground wiring.

Wildlife protection accessory

Wildlife guarding is an optional accessory that can be ordered for the NOVA NX-T recloser for wildlife protection. Due to its unique vented design, it allows water to easily drain through the wildlife guard and ample visibility to the terminal connection housed within the wildlife guard.

The wildlife guard uses a positive latching system to secure the wildlife guard securely to the recloser shed.

The wildlife guard is designed to secure itself around the first major skirt of the vertical and horizontal recloser bushing. If the load side voltage sensor accessory is installed, the wildlife guard shall have a notch to allow the load side sensor to safely extend into the guard for connection to the recloser top terminal.

Improper installation of the wildlife guard may affect voltage sensing accuracy of the load side voltage sensor. During inspection, ensure there are no trapped contaminants within the guard that may affect the load side sensor connection.

See **Figure 15** that showcases the wildlife guard installed on an example site ready recloser. **Figure 16** and **Figure 17** show how the wildlife guard for the load side voltage sensor is installed. The same process applies when installing the horizontal wildlife guard on the first major shed nearest to the horizontal recloser terminal.



Figure 15. Site-ready with wildlife guards

NOVA NX-T Recloser



Figure 16. Wildlife guard unlatched around the top bushing skirt



Figure 17. Top wildlife guard latched around the top bushing skirt

Integrated voltage sensor option (6 sensors)

The NOVA NX-T recloser is available with integrated voltage sensors for source- and load-side voltage sensing. This is accomplished by using a high-voltage resistor encapsulated within each interrupter module for source-side voltage sensing, and a load-side resistive sensor encapsulated in silicone rubber insulation connected to the recloser's load-side terminal. The integrated voltage sensors and recloser control system support a voltage-sensing magnitude accuracy of $\pm 2\%$ and a phase-degree accuracy of $\pm 1.5^\circ$ over the full rated ambient temperature range of the recloser and control. The accuracy for this system applies when the following conditions are met:

- Voltage range is greater than 50% to 100% of the rated maximum voltage of the recloser
- Ratio of load-to-source voltage magnitudes is between 0.5 and 2.0, inclusive
- Phase angle difference between load and source voltages is no greater than 30 degrees

The load-side voltage sensor can be installed at the factory, or can be installed in the field as a service kit. When installed, the load-side top terminal is connected to the recloser load-side terminal, and the end of the sensor is securely connected to the recloser tank head. The load-side sensor connections are made within the recloser tank head and transmitted to the frame's integrated junction box through a single cable using Eaton's MIL-DTL-38999 Series IV connector system.

A single 37-pin control cable is used to bring source and load voltages to the Form 6 NX-T control, in conjunction with other control cable signals including TRIP and CLOSE, recloser status, and current values. The control cable uses Eaton's MIL-DTL-38999 Series IV twist-lock cable connector design.

Service information

Service requirements

The NOVA NX-T recloser has been designed with a minimum mechanical life of 10,000 operations. The NOVA NX-T 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 NX-T recloser.

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 tests

NOVA NX-T 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 NX-T reclosers equipped with voltage sensing options may be influenced by the 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 following procedures to perform high-potential withstand tests at 75% of the rated low-frequency withstand voltage for 60 seconds. See **Table 10** for test voltages and **Figure 18** for test connection diagrams.

Table 10. NOVA NX-T recloser withstand test voltage ratings information

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

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

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

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

Test results for NOVA NX-T reclosers equipped with voltage sensing options may be influenced by the sensing resistor, especially if DC high-potential testing is performed.

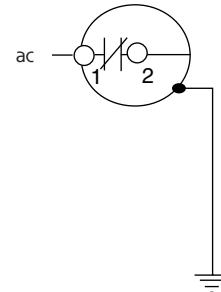
The following tests should be applied to each of the three single-phase reclosers that comprise the NOVA NX-T recloser system:

Closed contacts high potential test

1. Close the recloser contacts.
2. Ground the recloser using the grounding lug on the head casting.
3. Apply proper test voltage to one of the bushing terminals.
4. The recloser should withstand the test voltage for 60 seconds.

Closed Contacts High-Potential Insulation Level Withstand Test

Phase to Ground



Open Contacts High-Potential Insulation Level Withstand Test

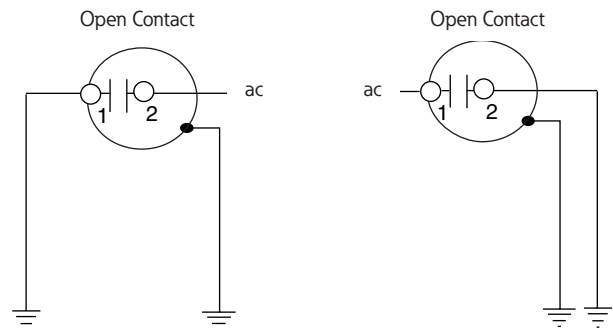


Figure 18. Connection diagrams for high-potential withstand testing for each single-phase recloser that comprises the NOVA NX-T recloser system

Open contacts high potential test

1. Open the recloser contacts.
2. Ground the recloser using the grounding lug on the head casting.
3. Ground the bushing terminal on one side of the recloser.
4. Apply the proper test voltage to the ungrounded bushing terminal.
5. The recloser should withstand the test voltage for 60 seconds.
6. Reverse the test and ground connections on the bushing terminals.
7. Apply the proper test voltage to the ungrounded bushing terminal.
8. The recloser should withstand the test voltage for 60 seconds.

NOVA NX-T Recloser

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 but fails the open-contacts test, the cause is likely to be in the interrupter assembly.

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 either the Open or Closed High-Potential Test, contact an authorized service center or your Eaton representative.

Note: Test results for NOVA NX-T reclosers equipped with voltage sensing options may be influenced by the sensing resistor, especially if DC high-potential testing is performed.

Module flashover service

If a NOVA NX-T recloser module was exposed to an external flashover, an inspection process is recommended to assure proper operation of the recloser. Should the NOVA NX-T 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 tests** 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 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 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 tests** section of this manual.

Troubleshooting

If the NOVA NX-T 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 CLOSED position).
- Check all cables for proper connection.
- Check the condition of the battery located in the control cabinet. Refer to *Service Information MN280088EN Form 6 NX-T Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* or *Service Information MN280089EN Form 6 NX-T/LS Microprocessor-Based 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 MN280088EN Form 6 NX-T Microprocessor-Based Pole Mount Recloser Control Installation and Operation Instructions* or *Service Information MN280089EN Form 6 NX-T/LS Microprocessor-Based Recloser Control Installation and Operation Instructions* for the battery testing procedure.

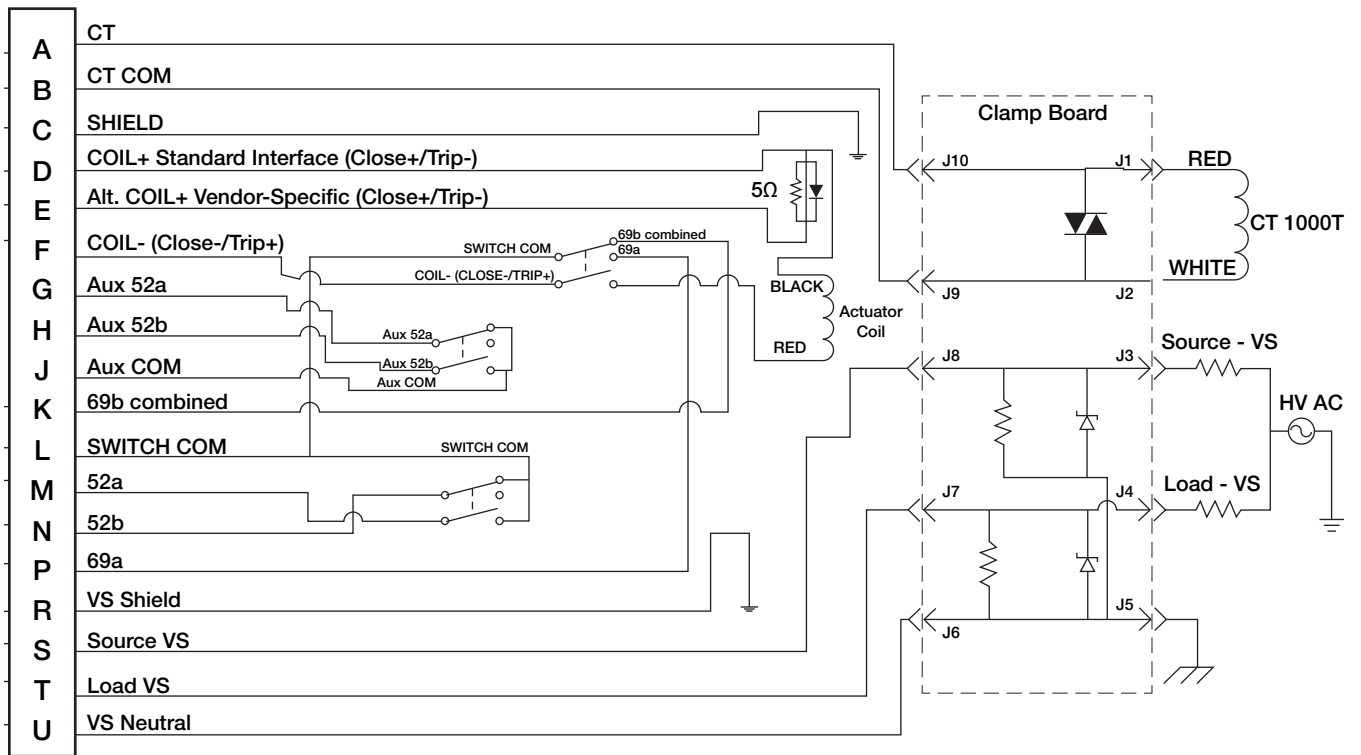


Figure 19. NOVA NX-T recloser internal wiring

NOVA NX-T Recloser

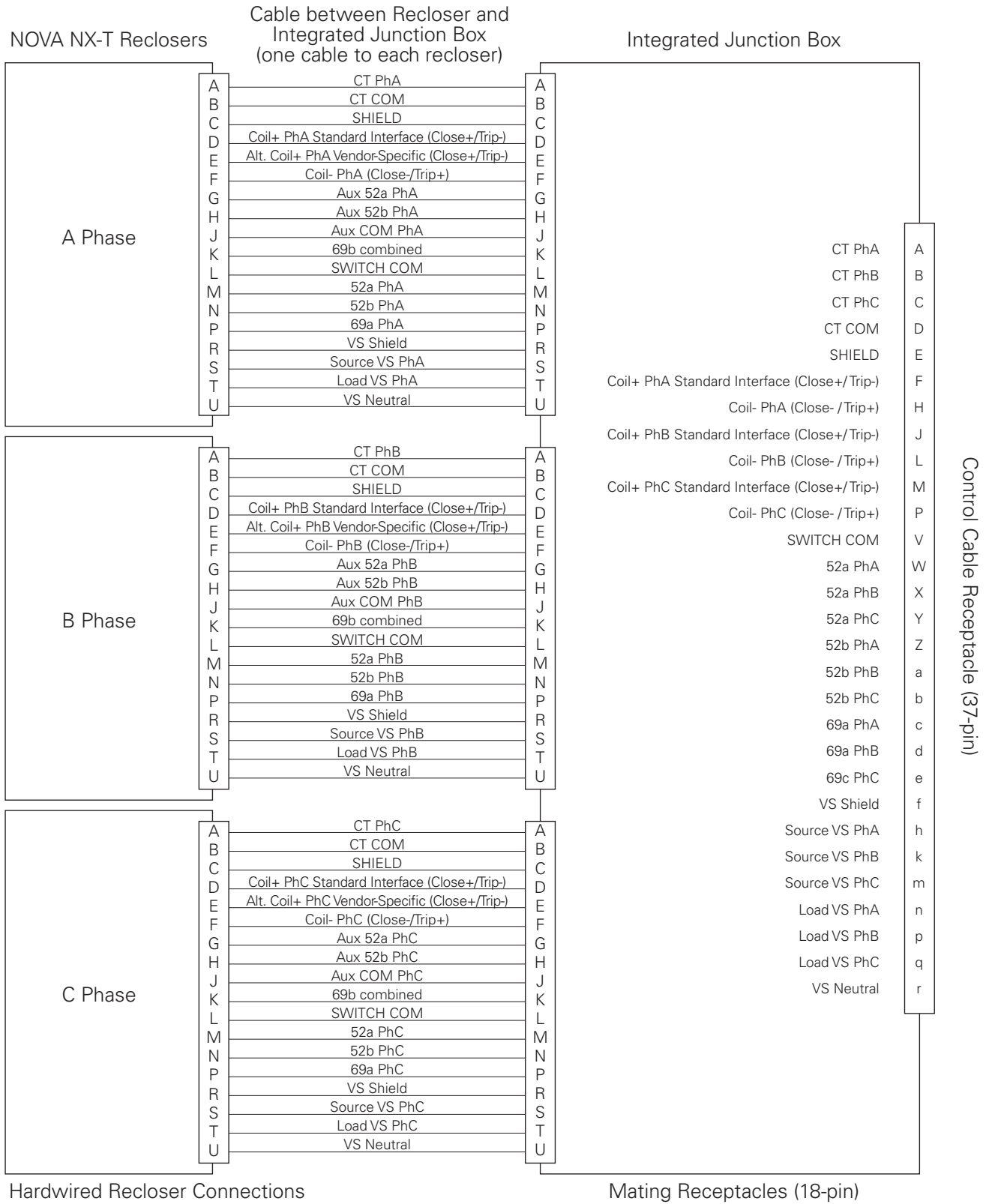


Figure 20. NOVA NX-T recloser, integrated junction box, and control connections

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Publication No. MN280087EN
March 2018
KA2048-0754 Rev 00

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